NETWORK WORLD
The Newsweekly of User Networking Strategies
Volume 7, Number 13
An International Data Group Publication
March 26, 1990

CeBIT '90 showcases OSI's power

By Paul Desmond
Senior Writer

HANNOVER, West Germany — In the largest display of OSI capabilities to date, vendors at last week's Hannover Fair CeBIT '90 showed that the technology is nearing the level of maturity needed for commercial use.

In two separate Open Systems Interconnection demonstrations, 50 hardware and software vendors demonstrated applications, including directory services and document handling, that let users network a diverse range of equipment and support links to suppliers and customers.

One of the demonstrations, CeBIT MultiNET '90, featured the integration of OSI and Transmission Control Protocol/Internet Protocols on a single network.

User companies involved in the demonstrations said they hope the events will convince other users that OSI products are available and functional.

"OSI is now at a stage that users should begin migrating to it," said Harald Nottebohm, head of the data communications department at Hoechst AG, a giant West German chemical company. "It's a time-consuming process. We are trying to convince users to

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Where ISDN implementations vary

Key incompatibilities in international implementations of CCITT Integrated Services Digital Network standards.

CCITT ISDN Standard	Function	Incompatibilities
Layer 1	Physical interface from customer premises equipment to public network.	Minor differences in electrical characteristics, such as maximum voltage, allowable noise and signal strength. Major problems between European 30B+D and North American 23B+D Primary Rate Interface implementations.
Layer 2	D channel link layer protocols that guarantee end-to-end error correction and retransmission.	No significant problems.
Layer 3	D channel signaling protocols that are used to establish and route transmissions.	Several major problems that make it difficult for customer premises equipment to work with central office switches from different vendors.

SOURCE: CORPORATION FOR OPEN SYSTEMS INTERNATIONAL, MCLEAN, VA.
GRAPHIC BY SUSAN J. CHAMPENY

Different flavors of ISDN hamper global net users

Incompatible implementations around the world lead to problems with equipment, applications.

By Barton Crockett
Senior Editor

The dream that ISDN would become the foundation of a standardized, global communications system is being threatened as carriers around the world deploy incompatible versions of the technology.

Incompatibilities will force Integrated Services Digital Network users to install different terminal equipment in various countries and may prevent use of advanced ISDN-based applications, such as automatic number identification (ANI), over international links.

"The initial vision that ISDN would be deployed everywhere to a universal standard just isn't happening," said Jonathan Gloster, a member of the technical services staff for McLean, Va.-based Corporation for Open Systems International and vice-chairman of the ISDN conformance testing group of the North American ISDN Users' Forum.

Gloster recently examined regional differences in ISDN standards and implementations for

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IBM adds potent new PS/2 LAN servers

Faster Model 80s gain performance from disk advances but don't rival emerging superservers.

By Susan Breidenbach
West Coast Bureau Chief

WHITE PLAINS, N.Y. — IBM last week announced two new Personal System/2 local-area network file servers that offer improved performance over existing PS/2s but fall short of qualifying for membership in the emerging class of superserver machines.

Based on the 25-MHz version of Intel Corp.'s 80386 chip, the two Model 80 PS/2s represent the first gereral-purpose microcomputers IBM has clearly positioned as LAN servers.

The Model 80 386 A31 and Model 80 386 A21 get their additional speed from a faster hard disk, use of memory and disk caching, as well as a 32-bit Small Computer System Interface (SCSI) bus master controller.

Benchmarks comparing the new systems with existing Model 80s were not available, but analysts said the new machines should perform better than existing PS/2s used as servers.

"They will provide tremendous relief to IBM customers who have needed a better server," said Leslie Fiering, an analyst with Gartner Group, Inc., a market research firm in Stamford, Conn. "I think the initial acceptance will be high because of pent-up demand."

Fiering and other industry ex-

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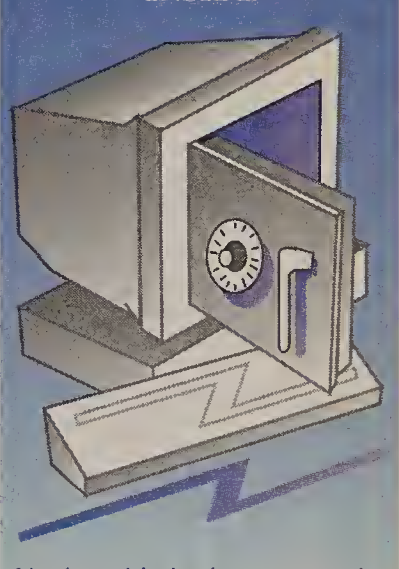
INSIDE



Hackers hit the Internet again. See story, page 4.

Vendor/user teams fill product gaps

By Paul Desmond
Senior Writer

What do you do when there are no commercially available products that meet your network needs?

For a number of leading-edge users, the answer is to team up with vendors to codevelop products that fit the bill.

Such partnerships can represent a win-win situation for both camps. Users get the tools they need at a lower cost in dollars and human resources. And vendors get valuable user input that goes a long way toward ensuring that products address real, rather than perceived, market needs.

Some recent examples of such codevelopment efforts include United Services Automobile Association's and Citibank, N.A.'s work with IBM on its ImagePlus imaging software.

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SPECIALTY CHAINS weigh plans to build a national shared network. Page 2.

CIGNA BUILDS multisite E-mail net using the LAN version of IBM's OfficeVision. Page 2.

MADGE NETWORKS' BID to overturn token-ring patent may have far-reaching ramifications. Page 2.

NORTHERN TEL TEAMS up with Nynex in PBX sales and service venture. Page 4.

AT&T MAKES IT EASIER for customers to upgrade access services. Page 4.

AUTOMAKERS pack "smart" cars with LANs. Page 31.

AT&T WILL SELL AUDIX voice mail as a stand-alone unit that works with other vendors' PBXs. Page 47.

NEWSPAPER

FEATURE

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Users pay one toll to bridge many token LANs

By Salvatore Salamone
Features Writer

The results of the latest *Network World*/LanQuest LAN test indicate that multiple bridges can be used to expand corporate networks without a serious decline in throughput.

The test found that, compared to a single token-ring network, there's an initial decrease in throughput when two token-ring nets are bridged together. However, there is virtually no further decline in throughput when subsequent nets are added to the network by bridging.

This test explores the issues users face when bridging token-ring networks using Novell, Inc.'s NetWare 2.15 and IBM Token-Ring adapter cards that switch between 4M and 16M bit/sec. Several single- and multiple-ring con-

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Specialty retailers mull shared network project

Store chains could use network for credit card authorizations, videoconferencing, as well as EDI.

By Bob Brown
Senior Editor

Specialty retailers are weighing plans to build a shared national network that would give them an economical way to speed credit card authorizations, employ videoconferencing and utilize electronic data interchange, *Network World* has learned.

Building a network with other retailers located in the same mall could enable specialty chains to take advantage of network technologies, such as very small aperture terminals, that they cannot afford on their own since most do not generate enough traffic to cost-justify a private network.

"We want the same benefits large retailers get from using private networks," said Fred Morsheimer, MIS director Trader Joe's Co., a food and beverage retailer in South Pasadena, Calif.

Members of the communications committee of specialty retailers within the National Retail Merchants Association (NRMA) will meet this June in Chicago to gauge interest in building a shared network. This topic, as well as services and equipment that could be used in the net, will also be discussed this October at NRMA's Retail Information Systems Conference in St. Louis.

More than a year ago, specialty retailers were urged by John

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Cigna uses OfficeVision to build distributed local net

Insurance firm's LAN delivers E-mail to 150 users.

By Tom Smith
New Products Editor

HARTFORD, Conn. — Cigna Corp. last week said it has built a distributed electronic mail network using the local-area network version of IBM's OfficeVision office software.

The company has 150 OfficeVision users on eight token-ring networks housed at multiple sites and is currently considering whether to expand use of the product, according to Ernie Smith, director of office productivity. Key factors in that decision include ongoing performance evaluations and IBM's recent announcement that delivery of OfficeVision Release 2.0 has been delayed from the first quarter to the fourth quarter.

"We anticipate at least some growth, but we have to get through the planning cycle," Smith said.

OfficeVision, announced in May 1989, is IBM's first product to comply with its Systems Application Architecture (SAA), a set of interfaces and protocols used to develop applications that operate across IBM's line of processors. Offered in mainframe, minicomputer and LAN versions, Of-

(continued on page 6)

Token-ring vendor could triumph in patent squabble

By Laura DiDio
Senior Editor

Patent attorneys and engineers say Madge Networks, Inc. has a good chance of persuading a U.S. federal court to invalidate Olof Soderblom's existing token-ring patent when Soderblom and Madge Networks meet in court sometime next year.

Last month, Soderblom and Madge Networks sued each other in federal court. Soderblom claims Madge Networks has infringed on his patent by selling token-ring products without licensing the technology from him. Madge Networks countersued to have the patent declared invalid.

The case has ramifications not only for Madge Networks but for the industry at large.

Invalidation of the patent would effectively render null and void the current licensing agreements Soderblom has with an estimated 50 token-ring vendors, including IBM, according to attorneys for both parties.

A victory by Madge Networks would also negate any potential royalty claims Soderblom might press in the future with Fiber Distributed Data Interface (FDDI) vendors, since FDDI is based on a token-passing scheme. A Madge Networks win could also result in cost savings for token-ring users, since vendors may pass on savings from royalty payments to their customers.

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Briefs

Report outlines AT&T market share. AT&T's share of the market for switched interstate traffic fell just one percentage point to 64.4% last year, according to a report released last week by the Federal Communications Commission.

Although its share of the total market slipped, the number of switched minutes the carrier handled increased by almost 8% last year, to 46.4 billion. The total switched interstate market grew 12%, to 72 billion minutes. AT&T's rivals also posted significant traffic growth. Although the figures were not broken down by carrier, the FCC reported that AT&T's competitors carried 25.6 billion minutes of switched traffic last year, up 20% from 1988.

All told, AT&T took in 75% of the industry revenue for switched interstate traffic.

Western Union faces Chapter 11. Western Union Corp. has told the Securities and Exchange Commission that it may be forced into Chapter 11 proceedings if it cannot restructure its debts or raise funds by selling off assets.

Robert Amman, Western Union's chairman, said the company will attempt to work out agreements with creditors or come up with a plan to reduce interest expenses before filing for protection under Chapter 11. Western Union has been selling off most of its transmission facilities and said it will try to sell its microwave network this year.

The company hit the financial skids largely as a result of facsimile transmissions cutting into its telex business. Its electronic mail and money-transfer businesses have also run into competition from MCI Communications Corp. and American Express Co.

Bullish on video growth. Dick Moeller, chief executive officer and president of Videotelecom Corp., the Austin, Texas-based videoconferencing firm, predicted his company will sell about 300 of its flagship Conference Management System videoconferencing units this year. The company sold 125 of the units in 1989, the first year they were available. Videotelecom trails market leaders PictureTel Corp. and Compression Labs, Inc., which together accounted for more than 90% of all U.S. videoconferencing system sales last year.

Windows on the network world. Netwise, Inc. last week announced it is shipping a version of its remote procedure call (RPC) tool for personal computers running Microsoft Corp.'s Microsoft Windows/286 and Microsoft Windows/386.

The product — RPC Tool for Windows — will simplify the creation of client/server applications that exploit the features of Microsoft Windows on a variety of networking platforms. These include any networks using the Network Basic I/O System or Novell, Inc. NetWare Internetwork Packet Exchange/Sequenced Packet Exchange (IPX/SPX) protocols. Additionally, RPC Tool for Windows will allow users to build customized Microsoft Windows-based server applications.

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International Networks
As one of the first steps toward integrating Europe's disparate public networks, 24 carriers are working to support common ISDN services, standards and applications by the end of 1993. **Page 17**

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Network World
161 Worcester Road
Framingham, Mass. 01701-9172
(508) 875-6400

Second-class postage paid at Framingham, Mass., and additional mailing offices. *Network World* (USPS 735-730) is published weekly, except for a single combined issue for the last week in December and the first week in January by Network World, Inc., 161 Worcester Road, Framingham, Mass. 01701-9172.

To apply for a free subscription, complete and sign the qualification card in this issue or write *Network World* at the address below. No subscriptions accepted without complete identification of subscriber's name, job function, company or organization. Based on information supplied, the publisher reserves the right to reject non-qualified requests. Subscriptions: 1-508-820-7444.

Non-qualified subscribers: $3.00 a copy; U.S. — $95 a year; Canada, Central & South America — $110 a year; Europe — $165 a year, all other countries — $245 a year (airmail service). Four weeks notice is required for change of address. Allow six weeks for new subscription service to begin. Please include mailing label appearing on front cover of the publication.

Network World can be purchased on 35mm microfilm through University Microfilm Int., Periodical Entry Dept., 300 Zebb Road, Ann Arbor, Mich. 48106.

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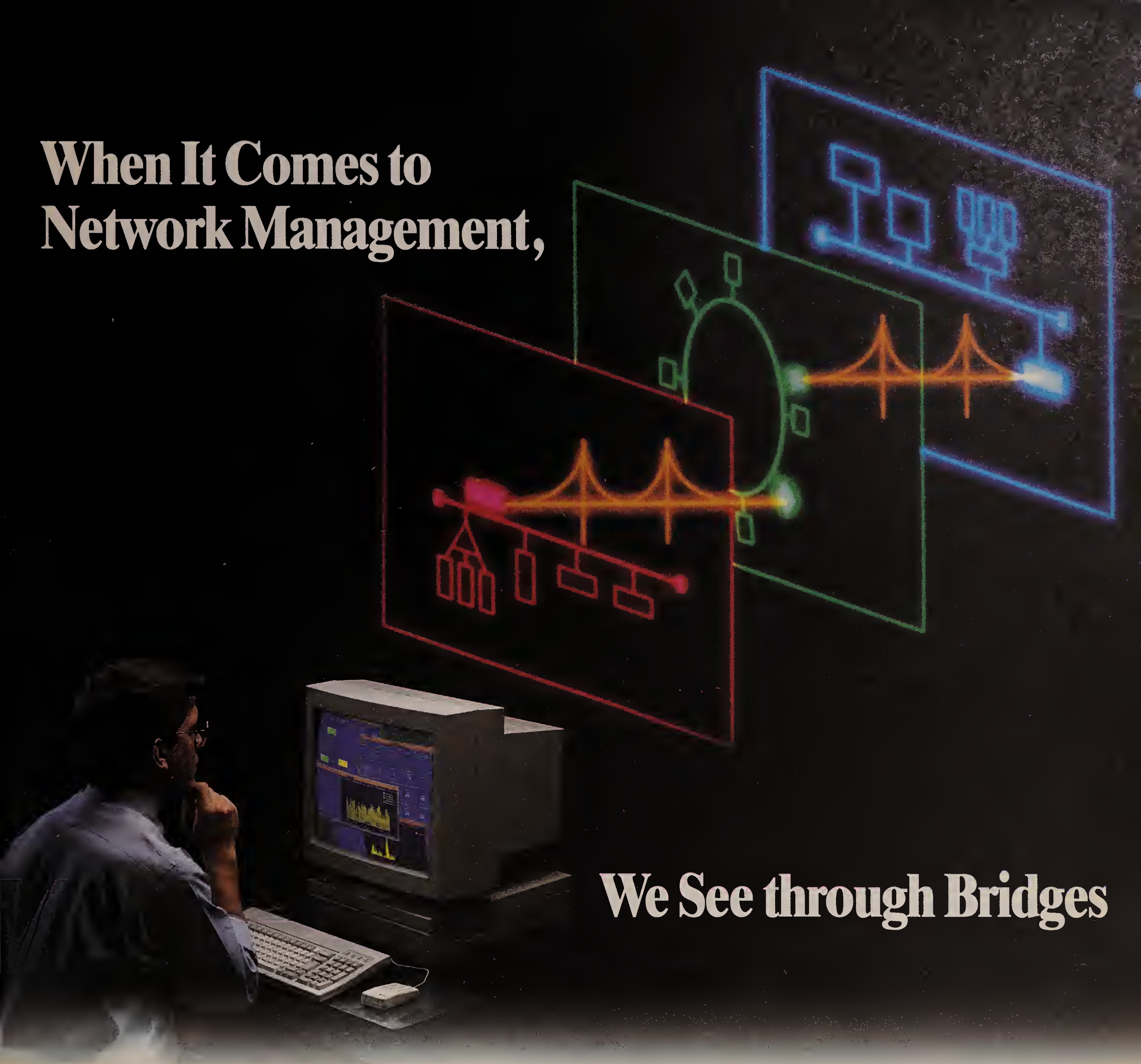

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See the FAXNeT Form on Page #46

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Northern Telecom to sell last PBX sales unit to Nynex

Companies will form joint venture, called Nynex Meridian Systems, to be 80% owned by Nynex.

By Bob Brown
Senior Editor

NASHVILLE — Northern Telecom, Inc. last week announced plans to form a sales and service partnership with Nynex Corp. that would be the final step in a plan to hand off direct sales of its PBXs to the regional Bell holding companies.

The letter of intent, signed by Northern Telecom and Nynex Business Information Systems Co., calls for the formation of Nynex Meridian Systems, a new business unit that would sell and service Northern Telecom's full line of customer premises equipment in New York and New England.

The Nynex deal would give Northern Telecom distribution agreements with every RBHC, in addition to pacts with other carriers, such as Contel Corp., and regional resellers.

Nynex Meridian Systems would assume sole responsibility for marketing and servicing Northern Telecom's Norstar, Meridian SL-1, Meridian SL-100/SuperNode and the new Meridian 1, which was introduced in January.

The agreement is expected to be completed within 45 days. Northern Telecom would own about 80% of the new business unit, sources said.

Similar deals

Northern Telecom signed a similar agreement with Pacific Telesis Group about three years ago, and in January, announced a distribution pact with Bell Atlantic Corp.

By agreeing to have the RBHCs distribute and service its products, the company gains wider market presence in each region of the country. It also increases the number of people selling and servicing its products without incurring the expense of hiring them. In turn, the RBHCs reap larger discounts from Northern Telecom because of increased sales volumes.

Users greeted the news of Northern Telecom's new partnership with optimism.

Kathi Johnson, associate director of telecommunications at Yale University in New Haven, Conn., said she has heard positive remarks from colleagues on the West Coast about a similar partnership between Northern Telecom and Pacific Telesis. "I don't imagine current customers will see much of a change," she said.

Orrin Getz, director of office automation for the New York State Urban Development Corp. and president of Northern Telecom's New York SL-1 Users Group, said Northern Telecom's pact with Nynex should increase competition and "keep other Northern distributors in the area on their toes."

AT&T moves to revamp digital rates

By Anita Taff
Washington Bureau Chief

WASHINGTON, D.C. — AT&T last week filed a proposal with the Federal Communications Commission to restructure and reprice the installation, connection and multiplexing charges for its digital private-line services.

The changes will simplify and, in some instances, reduce rates for its T-1, T-3, Dataphone Digital Service and Accunet Spectrum of Digital Services (ASDS), according to AT&T.

The changes will also make it easier for customers to upgrade access services, according to Ron Kornet, staff manager of product marketing at AT&T. "Customers have expressed a desire to move to higher [bandwidth] access, and reducing installation charges removes a hurdle," he said.

AT&T told the FCC it wants to restructure digital, private-line, central office connection charges by breaking them into two components: an access charge and a function charge.

The access component will cover the physical linking of a private line to another AT&T service at the central office, while the function charge will cover the cost of providing central office services such as multiplexing.

Currently, customers pay these central office connection fees in the form of onetime installation charges and ongoing monthly charges.

Under the proposal, customers would continue to pay for the access component of connection fees at the time of service installation and then on a monthly basis. The fee paid at installation would remain at current rates. Those charges vary by service but, as an example, the access component of the installation charges for a T-1 line costs $310 and $514 for a T-3 line.

The other access component, paid on a monthly basis, will remain the same for ASDS and Dataphone Digital Service, but will increase for T-1 and T-3 services — from $62 to

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Telecommuting may help firms keep good workers

High turnover forcing companies to offer options.

By Joe Panepinto
Staff Writer

Faced with a smaller and more diverse work force, users are looking to use telecommuting as a way to attract and retain qualified employees.

One reason for the surge in interest in telecommuting is that work-from-home options are especially well-suited to two of the fastest growing segments of the employment pool: retired workers and working mothers.

Between now and the year 2000, the number of women entering the work force will jump to 64%, from only 44% today, according to a study entitled "Workforce 2000: Work and Workers for the 21st Century," published by the Hudson Institute, Inc. In addition, as the huge Baby Boom generation ages, the number of retired workers looking to re-enter the work force will increase dramatically, the study said.

Telecommuting and flexible work-from-home programs can also help companies retain skilled employees by offering alternatives to the 9-to-5 grind.

"The thing that people fear the most right now is turnover because of the growing worker scarcity," said Tim Zerbiec, a telecommunications consultant at Vertical Systems Group in Dedham, Mass. "That's one of the things that makes companies consider telecommuting."

According to the "1989 Work-at-Home Survey" conducted by New York-based Link Resources, Inc., more than 1 million American workers telecommute. However, less than 9% of all work-from-home employees work for large companies, meaning businesses with 1,000 or more employees.

> "Most telecommuting today is informal and done by small companies."
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"Most telecommuting done today is informal and done by small companies with fewer than five employees," said Carol D'Agostino, a senior research associate at Link Resources.

The conclusions of the Link Resources study are supported by preliminary results from a survey of Fortune 1,000 companies conducted by Towers, Perrin, Forster & Crosby, Inc., a management consulting firm.

According to Joann Getchell, a senior research associate at the company, only 4% of Fortune 1,000 companies have formal telecommuting programs today. But the study shows that another 13% are either piloting or planning to implement a program in the next year.

The Travelers experience

As a result of growing difficulties in finding and retaining qualified workers, Hartford, Conn.-based The Travelers Corp. began a pilot telecommuting program in 1986 with five employees, according to Gus Bender, second vice-president of telecommunications.

That program has since expanded to include more than 120 claims and data processing workers in the Hartford area, he said.

Telecommuting employees are supplied with either an IBM Personal Computer AT or Personal System/2 microcomputer along with a Hayes Microcomputer Products, Inc. 2,400 bit/sec modem. Home workstations are linked to IBM System 3090 host computers in Hartford via SprintNet, an X.25 packet-switched net.

Claims processors also have a separate phone line installed in their homes that handles incoming calls routed from Travelers' headquarters via an automatic call distributor (ACD). The call routing is transparent.

Telecommuters at Travelers work at home four days of the work week and go into the office on the remaining day.

Bender says the company measured a 22% to 33% increase in telecommuter productivity

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The West Coast news bureau of *Network World* has recently moved. It is now located at 2088 Union St., Suite 2, San Francisco, Calif. 94123; (415) 771-3530.

Internet hacker frustrates users, eludes detection

By Bob Brown
Senior Editor

PITTSBURGH — A network security team at Carnegie-Mellon University here last week said a hacker infiltrated the Internet in recent weeks, taunting network experts but causing no damage.

The Computer Emergency Response Team (CERT), a federally financed computer security agency formed in late 1988 after an attack on the Internet by Robert Morris Jr., said the hacker had broken into computers at Los Alamos National Laboratory, Digital Equipment Corp. and Harvard University, among others.

Internet is one of the world's foremost research networks, linking thousands of computers at corporations, nonclassified military installations, government labs and universities.

Users reported no major damage, except that systems administrators were forced to abandon their regular duties to attend to the security breaches and users were temporarily logged off their systems to have their computers checked for security problems.

In a phone call to *The New York Times* last week, a man

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Addenda: The Buyer's Guide to digital and analog line test equipment ("Passing the test," *NW,* Nov. 6, 1989) did not include products from Telecommunications Techniques Corp. (TTC) of Germantown, Md. TTC offers several products in this market, including the Fireberd 4000 and Fireberd 6000 Communications Analyzers. For more information, contact TTC at (800) 638-2049.

In our Buyer's Guide on network design tools titled "Network by design" (*NW,* March 12), Network Management, Inc.'s (NMI) product was inadvertently omitted.

The Modular Interactive Network Design (MIND) software tool, acquired by NMI from Contel Corp. last year, is available in two versions: MIND-Data and MIND-Pricer. Both run on either personal computer, local-area network or Digital Equipment Corp. VAX platforms. A time-sharing version is also available. These products offer graphics and plotter output. They vary in price from $5,000 for the time-share version to $200,000 for the VAX version.

Correction: A chart listing prices for UUNET Communications Services, Inc.'s AlterNet public network (*NW,* March 19) contained a typographical error. The last entry in the chart should have read 9.6K bit/sec asynchronous.

BellSouth unveils digital data-over-voice service

Carrier's successful field trial sent 19.2K bit/sec POS data and a voice signal over telephone line.

By Wayne Eckerson
Senior Writer

ATLANTA — BellSouth Corp. announced last week that it has successfully field-tested a data network service using digital data-over-voice (DDOV) technology and it plans to tariff the service later this year.

In the trial, BellSouth's FastConnect service made it possible to simultaneously transmit a 19.2K bit/sec digital point-of-sale data transaction and an analog voice signal over a dial-up telephone line.

The service reduces the average response time for a POS transaction from 28 seconds to eight seconds and eliminates the need and expense of maintaining separate voice and data lines.

FastConnect is based on DDOV technology recently patented by Integrated Network Corp. (INC) of Bridgewater, N.J. The new technology is an improvement over traditional data over voice because it transmits data in an all-digital format, according to Craig Bender, director of marketing for INC.

It also provides the same level of bit error-free seconds as AT&T's Digital Dataphone Service and allows for more rapid problem isolation, Bender said.

While BellSouth will be an early user of DDOV, it won't be the first. Last year, Nynex Corp. tariffed a DDOV service in New York and Massachusetts that is suited for multidrop applications for lottery networks and automated teller machine nets. Southwestern Bell Telephone Co. also recently tariffed a central office local network service based on DDOV.

Trial setup

In the trial, J.C. Penney Business Services, Inc. used BellSouth's FastConnect service to provide credit card authorization and POS reports to six Citgo Petroleum Corp. retail locations here. J.C. Penney Business Services processes POS transactions for more than 23,000 service stations, convenience stores and other retail stores nationwide.

To support an analog phone and a VeriFone, Inc. credit authorization terminal, the Citgo locations used an INC device about the size of a modem called a 192 Data Voice Multiplexer.

The 192 Data Voice Multiplexers took data from the VeriFone device at 2,400 bit/sec and transmitted it to an INC channel unit at a central office at 19.2K bit/sec while simultaneously transmitting analog voice signals.

The INC channel unit in the central office separated the data and voice signals, routed the voice onto the public network and the data across a four-wire 64K bit/sec DS0 channel to BellSouth's PulseLink packet network.

PulseLink delivered the data to J.C. Penney Business Services mainframes in Lenexa, Kan., which carried out the credit check and transmitted the approval or rejection back the same way.

DDOV is able to reduce the response time for POS transactions because it avoids the inherent call setup delays of the public switched network. POS data is transmitted directly from INC channel units at the central office to a packet network without ever going through a voice-grade

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Banks back consolidation of regional ATM networks

By Jim Brown
Senior Editor

SAN FRANCISCO — Some of the nation's leading banks and ATM network providers last week said they favor a reduction in the number of regional ATM nets in order to cut operational costs and avoid service duplication.

Consolidating the number of automated teller machine networks into a handful of regional supernets would eliminate service duplication and drive down the cost of routing traffic from one bank's ATM to another bank's data center, according to attendees at the Electronic Funds Transfer Association's 1990 EFTAnnual show here.

Banks that favor ATM network consolidation also point out that it would help eliminate customer confusion about which ATMs they can use to obtain cash.

Many bankers at the EFTA show said they believe the number of regional networks will dwindle from about 90 today to less than 10 over the next decade. These regional networks are operated either by a single owner, one large bank in a consortium or by nonprofit companies established by a consortium.

"There is a multitude of names and systems," said Del Tonguette, president of Gulfnet, Inc., an ATM network with 190 member banks and 2,100 ATMs spread across Arkansas, Louisiana, Mississippi, Tennessee and Texas. "We can't keep them straight in our minds. The public has problems too," he said.

ATM transactions are routed over these networks to a central hub, which switches traffic among different banks' host computers within certain geographical areas.

Banks that favor consolidation point out that it would eliminate customer confusion.

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In addition to the regional nets, there are two national networks — Plus System, Inc. and Cirrus System, Inc. — that route transactions between their members nationwide. Cirrus is owned by MasterCard International, Inc., while Visa USA, Inc. owns about 33% of Plus. A group of 56 other banks own the remaining stake in the Plus net.

Most banks link their ATMs via leased lines to their own host computer or data processing service bureau. In addition, those banks or service providers will link their hosts via leased lines to a regional network switch, which is typically a fault-tolerant on-line transaction processor.

When the customer of one bank uses the ATM of another, the bank owning the ATM routes the transaction to the switch. The switch then passes the transaction to the bank holding the customer's account for processing.

Forming regional and national networks enabled banks to quickly increase the number of ATMs that accept their cards. The nets also enabled member banks without ATMs to issue cards that can be used at other banks' ATMs.

But this plethora of regional and national networks, each with its own logo, confuses customers, according to bankers.

To reduce confusion, Gulfnet's Tonguette said banks should merge existing regional networks into a handful of large regional nets, each of which would supply switching services for broad geographical areas.

Because interconnecting large regional networks would duplicate the existing national networks, Tonguette said Plus and Cirrus should dismantle their networks.

Consolidation of regional networks will likely occur as banks merge or acquire one another, said Richard Yanak, president of New England Network, Inc., which operates the Yankee 24

(continued on page 42)

Visa bolsters int'l credit net, adds Japan data center

Company also expands center in McLean, Va.

By Jim Brown
Senior Editor

SAN MATEO, Calif. — Visa USA, Inc. last week announced plans to expand its VisaNet worldwide credit card authorization network by adding a new data center in Yokohama, Japan, and expanding its data center in McLean, Va.

At a press briefing here, Visa officials said the new Yokohama data center and the upgrade to its McLean facility are part of its plans to meet Visa's ever-growing transaction volumes.

The $5 million data center in Yokohama will off-load processing chores from Visa's data center in San Mateo, Calif.

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That growth is being driven, in part, by Visa's efforts to encourage use of credit cards in new locations, such as fast food restaurants and doctors' offices. Visa is also rolling out a debit card program that will enable merchants to use VisaNet to debit customer bank accounts.

The $5 million data center in Yokohama will off-load processing chores from Visa's San Mateo data center, where Asian transactions are currently processed. It will also help Visa trim its communications budget by eliminating circuits that route traffic from Asia to McLean when the San Mateo data center goes down.

The data center in Yokohama will support the same network architecture Visa uses in the U.S. Terminals in merchant locations will be linked to Visa member bank hosts via leased or dial-up lines. Member banks will then be linked to one of two Visa concentrator sites via leased lines.

Those concentrator sites in Hong Kong and Singapore are currently linked to the San Mateo data center via six 19.2K bit/sec channels on an AT&T transpacific cable. Visa also leases two 19.2K bit/sec satellite channels from AT&T to provide alternate routing.

In the future, the Asian concentrator sites will be linked directly to the Yokohama data center. The transpacific cable will remain in service to provide an alternate path to the San Mateo data center should the Yokohama center fail.

In the U.S., banks are linked to Network Equipment Technologies, Inc. Integrated Digital Network Exchange T-1 multiplexers in Visa concentrator sites. Traffic is routed over the T-1 backbone to either the San Mateo or McLean data center. Each U.S. data center has enough spare processing capacity to take over for the other in the event of a failure.

The Yokohama data center, expected to be on-line by year end, will be equipped with two IBM 4381 mainframes, which will process about 200 million transactions per year from 253 Visa members in 17 Asian countries.

Although the Yokohama data center will not greatly improve response time, it will enable a staff of nearly 50 to respond more quickly to network or processing problems encountered by Visa's Asian members.

Currently, Visa's Asian office has a staff of about 30 who work limited shifts, and sometimes Asian Visa members have to rely on workers in the San Mateo data center to resolve problems.

Expected transaction volume growth is also forcing Visa to expand its McLean data center. Visa will construct a 60,000-sq-ft building that will replace its existing 15,000-sq-ft data center. The former data center will house administrative staff.

The $17.5 million McLean data center expansion project includes the purchase of a new IBM 3090 mainframe.

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The $17.5 million data center expansion project includes the purchase of a new IBM 3090 mainframe that will replace an aging and less powerful 3090, said Neil Waldo, senior vice-president for VisaNet Delivery Systems.

The McLean data center expansion comes two years after Visa completed a similar project to upgrade its San Mateo data center. Visa expects the new data center to come on-line in May 1992.

Visa also has a data center in London that processes credit card authorizations for its European members. Massey said Visa will link that data center by year end to the McLean data center for backup recovery purposes.

Ohio Bell files plans to offer 3 CLASS services, including ANI

By Bob Wallace
Senior Editor

COLUMBUS, Ohio — The Ohio Bell Telephone Co. last week filed tariffs with the Public Utilities Commission (PUC) of Ohio for three Custom Local Area Signaling Services (CLASS), including automatic number identification.

Ohio Bell is the first Ameritech company to file plans to offer caller ID, a service that provides a customer with the calling party's telephone number. The Bell operating company will also offer automatic callback and repeat dialing services.

With automatic callback, a customer's phone can automatically redial the number of the last caller, whether or not the call was answered. With repeat dialing, users can have their phones continue dialing a busy number until the call goes through. Each service will cost $3.50 a month.

Ohio Bell plans to roll out the three CLASS services to business and residential users on the east side of Cleveland this summer, in Columbus next year and then statewide, a company spokesman said.

Ameritech said it expects Illinois Bell Telephone Co. and Indiana Bell Telephone Co. to file tariffs for caller ID services by year end, with Michigan Bell Telephone Co. and Wisconsin Bell, Inc. following suit in 1991.

With caller ID, the caller's main billing number appears on a display device attached to the telephone. The display units typically cost $40 to $50 each.

"We are excited and are definitely looking forward to using caller ID," said John LeSueur, corporate manager of telecommunications for Cleveland-based Sherwin-Williams Co. During peak calling hours, customers trying to reach sales representatives are sometimes put on hold or receive busy signals, he added.

"With caller ID, we could build an application that captures those numbers and passes them to agents who would call back these customers when call volumes [subside]," LeSueur said.

Caller ID users will be charged $6.50 a month for delivery of up to 300 telephone numbers and 2 cents for each additional number. "That's a palatable price," LeSueur said.

The Ameritech companies will offer caller ID without blocking, meaning callers' numbers will appear on the display device whether they like it or not.

"Offering blocking would greatly reduce the value of the service. We don't want the popularity of the service to diminish in any way," the spokesman said.

Ameritech said it expects Illinois Bell and Indiana Bell to file tariffs for caller ID services by year end.

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Ohio Bell hopes to avoid the problems Bell Telephone Co. of Pennsylvania encountered when it announced plans to offer caller ID service without blocking.

On Dec. 29, 1989, a state appeals court judge in Pennsylvania barred the carrier from offering caller ID until related legal issues could be resolved ("Court weighs legal issues of caller ID," *NW,* Jan. 8.)

The action stemmed from a suit filed against the Pennsylvania PUC by the Pennsylvania Coalition Against Domestic Violence and the American Civil Liberties Union. The suit asked that users be allowed, free of charge, to prevent their phone numbers from appearing on the display device on the recipient's telephone. The suit is still pending. ◘

Cigna to build distributed local net

continued from page 2

ficeVision features a common graphical user interface and allows users of IBM's various hardware platforms to exchange electronic mail, documents and data ("IBM SAA programs offer systems unity," *NW,* May 22, 1989).

At Cigna, users are employing OfficeVision principally to exchange E-mail. The token-ring LANs also have gateway access to a mainframe in Windsor, Conn., running IBM's DISOSS, which acts as an E-mail "switching station," enabling these LANs to exchange mail with third-party and other IBM systems.

While OfficeVision has enabled Cigna to build an E-mail net linking remote LAN users, the product's true productivity benefits won't be realized until Release 2.0 becomes available, Smith said.

Unlike the current version, Release 2.0 will support a variety of OS/2 application programs from IBM and other vendors. Under the OfficeVision umbrella, users will work with a common graphical interface to activate those programs, switch from one to another and pull data from the applications into documents and messages created under OfficeVision.

Release 2.0 "starts allowing integration on the desktop so the whole office environment [the different application programs in use] becomes part of the platform that you've got available," Smith said.

Another factor Cigna must evaluate is the development of third-party SAA software. The company currently uses WordPerfect Corp.'s WordPerfect and Lotus Development Corp.'s 1-2-3.

"We're certainly very interested in seeing what both those companies bring to the market," he said.

The shipping delay for Release 2.0 must also be considered, Smith said. "We're still going through the assessment of what the delay means to us," he said.

The company is currently conducting evaluations of OfficeVision's performance, and although it is being used in production environments, the jury is still out. "Where we have it in production, there are typically small numbers of users and it does well there," Smith said. "But the kinds of things we need to do to truly stress it are still going on, and we really don't have the results back from that."

Smith said he could not cite a specific date when the company will decide on its OfficeVision plans. ◘

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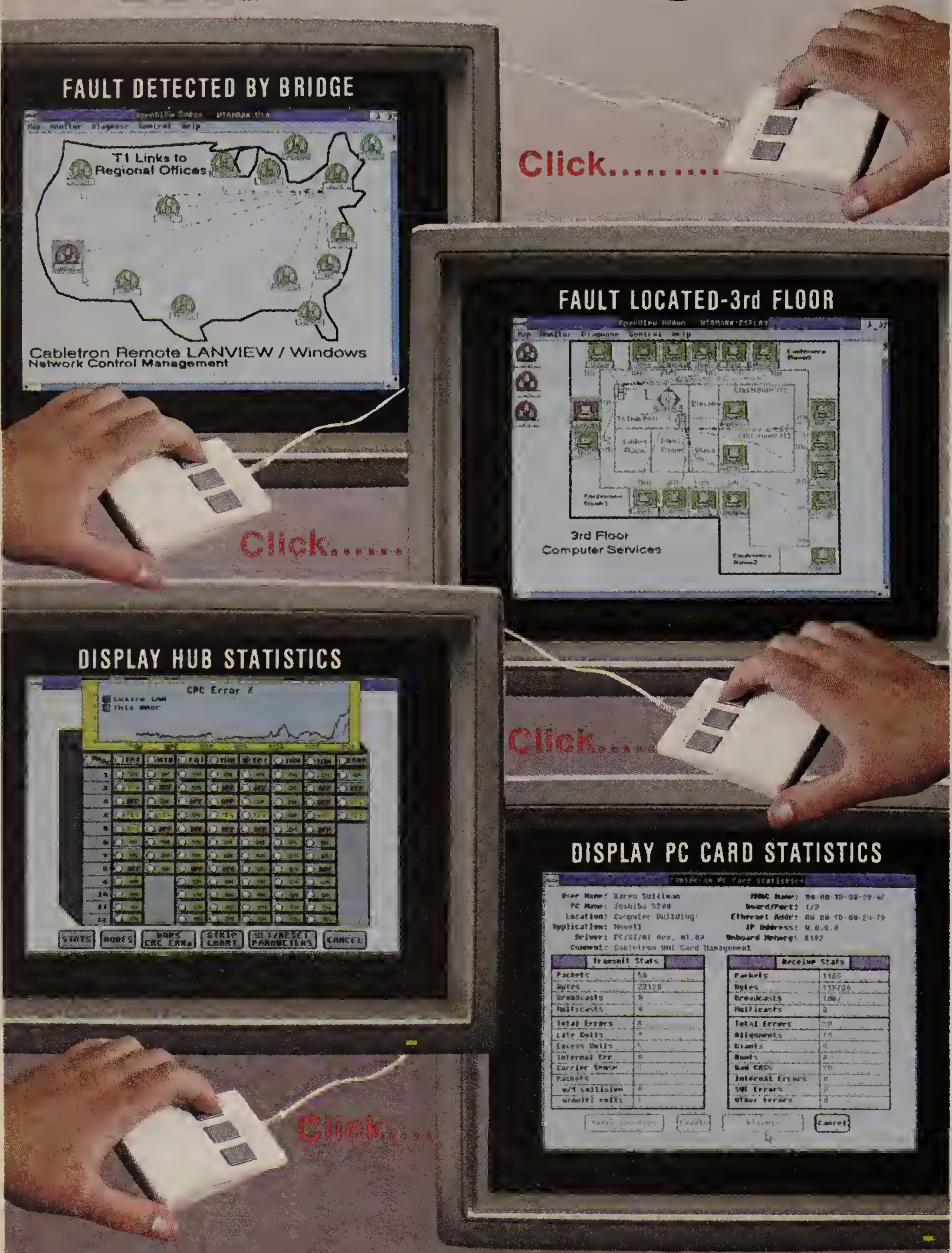
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See the FAXNeT Form on Page #46

INDUSTRY UPDATE

VENDOR STRATEGIES, MARKET TRENDS AND FINANCIALS

Worth Noting

"Banyan [Systems, Inc.] could use a sugar daddy with deep pockets to take care of it."

Doug Gold
Director of network research
International Data Corp.
Framingham, Mass.

People & Positions

Microsoft Corp. last week named **Michael Hallman** president and chief operating officer. He will succeed **Jon Shirley**, who announced his retirement from the Redmond, Wash.-based software maker in December.

Microsoft is luring Hallman from a comparable post at Boeing Computer Services Co., where he served as president since 1987.

At Boeing, Hallman oversaw operations of the aircraft company's 43,000 personal computers and external computer services profit center.

V. Orville Wright, who came out of retirement in 1987 to become chief executive officer at **MCI Communications Corp.** following a heart attack that sidelined Chairman and then-CEO William McGowan, has once again announced his retirement.

McGowan will resume sole responsibilities as chairman and CEO. Wright, who retired as president and chief operating officer at MCI in 1985, will continue as vice-chairman and a member of MCI's board of directors.

Thomas Volk was named manager of systems integration at **Sony Corp.'s** Video Conferencing and Satellite Systems Division in Park Ridge, N.J.

Volk will be responsible for establishing cooperative relationships between Sony and leading video communications systems integrators.

Previously, Volk served as manager of teleconferencing engineering at NEC America, Inc. ◘

UMass, DEC unveil plans for interoperability project

Effort to pave way for distributed processing.

By Bob Brown
Senior Editor

AMHERST, Mass. — The University of Massachusetts (UMass) here and Digital Equipment Corp. have announced a three-year, $6 million project designed to smooth communications between multiple vendors' workstations on a network.

The effort, dubbed "Project Pilgrim," is expected to identify and generate a set of software for distributed processing across nets that will benefit DEC, UMass and, in time, the general user community.

Project Pilgrim is a follow-up effort to the $50 million "Project Athena" collaboration, which was started in 1983 by DEC, IBM and the Massachusetts Institute of Technology. Project Athena spawned X Window System, among other technologies.

"We can only hope that Project Pilgrim will be as successful as Project Athena has been," said Charlie Wilson, DEC's program manager for Project Pilgrim. "Athena was pure research, whereas Project Pilgrim will focus on developing advancements over that base work."

For DEC, which is picking up three-quarters of the project's tab, Project Pilgrim is expected to help the company find a way for its proprietary VMS operating system to communicate better with other operating systems on a net. DEC hopes to translate its research here into commercial products, Wilson said.

"One of first things to come out of this project should be the integration of VMS systems into the base Athena environment," Wilson said.

> "We can only hope that Project Pilgrim will be as successful as Project Athena."

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In the second and third years of the project, Wilson said project engineers will focus on supporting multiple protocols, such as DECnet and Transmission Control Protocol/Internet Protocol, on the same network in a manner that is transparent to the user. While networks currently can support multiple protocols, they

(continued on page 8)

INDUSTRY BRIEFS

3Com Corp. last week continued its financial rebound by posting $6.7 million in earnings for its fiscal third quarter ended Feb. 28, a 27% increase over second-quarter results.

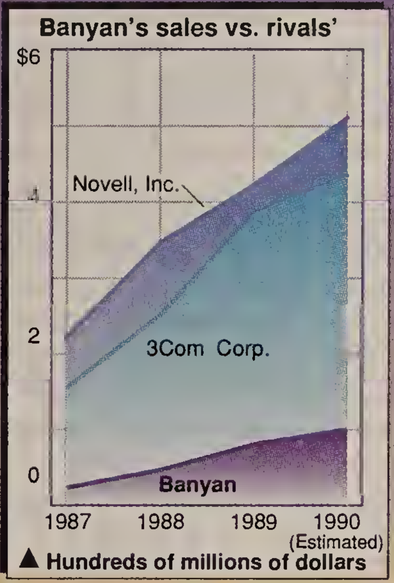
Third-quarter earnings were still off 37% from the $10.7 million the company posted in last year's third quarter, but the results indicate 3Com's financial health is improving.

3Com's earnings and sales decreases for the third quarter, compared to a year ago, reflect a transition from an old product cycle to a new one, a company spokeswoman said. Last quarter, the company began to see growing sales of several new products, including the 3Server/500 and 3+Open 1.1, she said. Sales for the Santa Clara, Calif.-based local-area network vendor were flat, dipping from $107.3 million for the third quarter last year to $107.1 million in this year's third quarter.

US Sprint Communications Co. and **Soft-Switch, Inc.** last week announced they have teamed up to provide users with a service for transmitting spreadsheets, graphics and other binary data over the SprintMail network.

The new Soft-Switch X.400 Gateway Model-10 and Model-20, in conjunction with US Sprint's SprintMail Service, will let users swap spreadsheets, software programs, engineering drawings, computer-aided design/computer-aided manufacturing files and other binary data, in addition to text messages. For example, a company using the service could send a spreadsheet with production forecasts to a supplier for planning just-in-time manufacturing. Customers must install Soft-Switch's X.400 gateway on their network to access the service. ◘

Banyan miniprofile



Founded: August 1983

Primary products:

- ☐ VINES, a distributed network operating system software
- ☐ Server hardware

Sampling of major customers:

- ☐ Federal Deposit Insurance Corp.
- ☐ University of California
- ☐ The Boeing Co.

GRAPHIC BY SUSAN J. CHAMPENY

SOURCES: BANYAN SYSTEMS, INC., WESTBOROUGH, MASS., AND SALOMON BROTHERS, INC., NEW YORK

Banyan thinks time is right for VINES

Users starting to demand naming services, host integration features of NOS for corporate LANs.

By Bob Brown
Senior Editor

WESTBOROUGH, Mass. — Banyan Systems, Inc. President David Mahoney admits that many users weren't ready for his company's approach to corporatewide local-area networks in the 1980s, but now times have changed.

Banyan is getting a second chance, industry watchers agreed, because users that flocked to departmental LAN vendors in the 1980s are now seeking advanced features that Banyan's VINES distributed operating system has offered all along.

Unix-based VINES provides such attractions as the StreetTalk global naming service — which lets users transparently access resources regardless of their location on the net — as well as the ability to integrate mainframes, minicomputers and microcomputers into LAN environments.

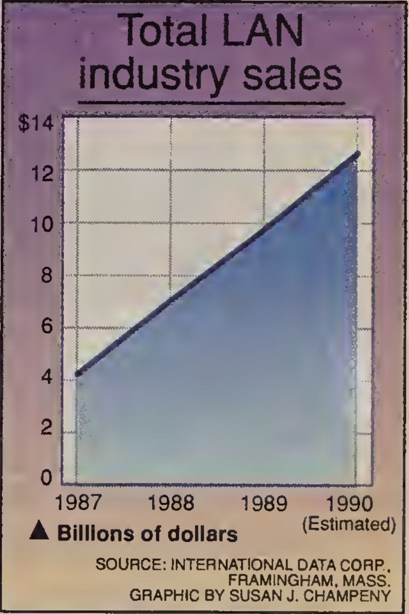
Banyan officials contend that even though they may have been ahead of market demand, Banyan is now better positioned to serve users with corporatewide LAN needs than other vendors.

However, the 8-year-old company faces several marketplace and internal challenges in its bid to serve users' increasingly sophisticated LAN needs. LAN and computer system vendors that have large installed bases and deep pockets are beginning to edge in on Banyan's market. And internally, Banyan needs to create a consistent marketing plan and bring stability to its work force, which has been shaken by the recent departure of several top executives.

As summed up by Rich Edwards, a partner at the investment firm of Robertson, Stephens & Co. in San Francisco: "Being smaller than rivals Microsoft [Corp.] and Novell [Inc.], the challenge for Banyan is to leverage its technical strength into a strong market position. Banyan needs to make its target market clear."

Ahead of the field

Mahoney acknowledges that the company hasn't reached earlier aspirations. "I thought we'd be sitting where we are today back in 1988," he said. But Mahoney contends that users in the 1980s "were not ready to move at a strategic or corporate level" to a distributed network operating system such as VINES.



SOURCE: INTERNATIONAL DATA CORP., FRAMINGHAM, MASS.
GRAPHIC BY SUSAN J. CHAMPENY

Even while Banyan has been able to attract large users such as The Boeing Co. and grow its sales from $24 million in 1987 to $80 million last year, competing firms pitching departmental

(continued on page 8)

UMass, DEC unveil interoperability plans

continued from page 7

cannot do so in a manner that is unseen by the user, Wilson said.

The project will focus on developing methods to help users migrate from existing networks to Open Systems Interconnection nets. Furthermore, the project will tackle such issues as supporting multiple name services over a network, Wilson said.

Project Athena focused on a homogeneous network of DEC computers running Ultrix, DEC's version of Unix. Project Pilgrim, on the other hand, has the task of tying together some 500 workstations and about 15 types of different vendors' equipment at the UMass Computer & Information Science Department (COINS) and College of Engineering.

"Project Pilgrim is designed to extend Project Athena into a heterogeneous model," said Paul McOwen, deputy chairman of COINS.

Ultimately, more than 3,000 engineers, scientists and students on the Amherst campus will have access to this open network from a variety of vendors' computers. Faculty can also use the project for research and course material development.

W. Richards Adrion, chairman of COINS, said Project Pilgrim will provide "a very large test site" for DEC. "Beyond that, project planners view Pilgrim as a pathfinder for software innovations that will eventually affect the entire computer industry," he said. ◪

Banyan thinks time is right for VINES

continued from page 7

LANs have a big head start. Novell, for example, nearly doubled its sales from 1987 through 1989 to reach $421.9 billion in sales (see graphic, page 7).

Highly referenceable customers

But now that more users may be ready to commit to Banyan, Mahoney plans to build on a "highly referenceable" customer base in pursuing what he described as the fastest growing LAN market segment: distributed corporate LANs used by Fortune 1,000 companies.

These companies will be particularly attracted to Banyan's top-down approach to networking, which integrates users' mainframes, minicomputers and microcomputers, Mahoney said. This is crucial in providing centralized control of distributed applications.

Competitors such as Novell, on the other hand, have taken more of a bottom-up view of the corporate LAN market based on smaller, departmental nets, he said.

"We have always had an orientation toward larger networks," Mahoney said. "I differentiate that from the problem that has been most often addressed in the market, which is that of clustering PCs together, sharing files and providing some connectivity outside of the work group."

But Banyan's competitors, such as Novell and 3Com Corp., are branching out from smaller networks to enterprise nets. Novell, for example, has announced plans to provide global naming services for its NetWare network operating system. And some observers question how much of a technical lead Banyan really has.

"From a technical standpoint, Banyan still has an advantage, but that window is rapidly closing," warned Doug Gold, director of network research at International Data Corp., a Framingham, Mass.-based market research firm.

Mahoney scoffed at such claims. "Keep in mind that we designed our products around the concept of directory services; others did not," he said.

Achilles' heel

Losing its technological edge is the least of Banyan's worries, many observers said. The company's well-documented Achilles' heel continues to be its marketing and sales group, which Mahoney said could have done a better job getting Banyan's message and products out to potential users.

> "Keep in mind that we designed our products around the concept of directory services; others did not," Banyan's Mahoney said.
>
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Even existing customers that are generally satisfied with their Banyan products point to Banyan's marketing as a major weakness.

Banyan "has trouble getting the word out about new products to customers," said Deborah Soper, LAN systems analyst at Ohio State University in Columbus, a Banyan customer since 1986. "Sometimes you'll go to a users group meeting and ask other users if they've heard anything about a new product, only to find that others have actually been using it for six months."

Mahoney said Banyan is taking action to strengthen its marketing and sales strategy, even as the dust settles from last month's dismissal of Jack Kay, vice-president of sales and marketing. For example, Banyan is working more closely with resellers that have both a national focus and the ability to provide service to large corporate LANs, he said. ◪

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TELECOMMUNICATIONS

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Worth Noting

The Independent T-1 Users Association, a users group for customers of T-1 services, will hold its third annual conference April 23 to 25 at the Hyatt Arlington Hotel in Arlington, Va. For more information, call (703) 734-7050.

Carrier Watch

Williams Telecommunications Group, Inc. (WTG), a national private-line carrier based in Tulsa, Okla., last week announced that it is enhancing its fractional T-1 service to support clear-channel 64K bit/sec transmissions.

Although WTG's current fractional T-1 service is offered in 64K bit/sec increments, only 56K bit/sec of that bandwidth was available to customers because the carrier used a line-coding technique, alternate mark inversion, that uses up 8K bit/sec of bandwidth per circuit.

WTG's ongoing migration to bipolar eight zero code substitution line coding is freeing up that bandwidth.

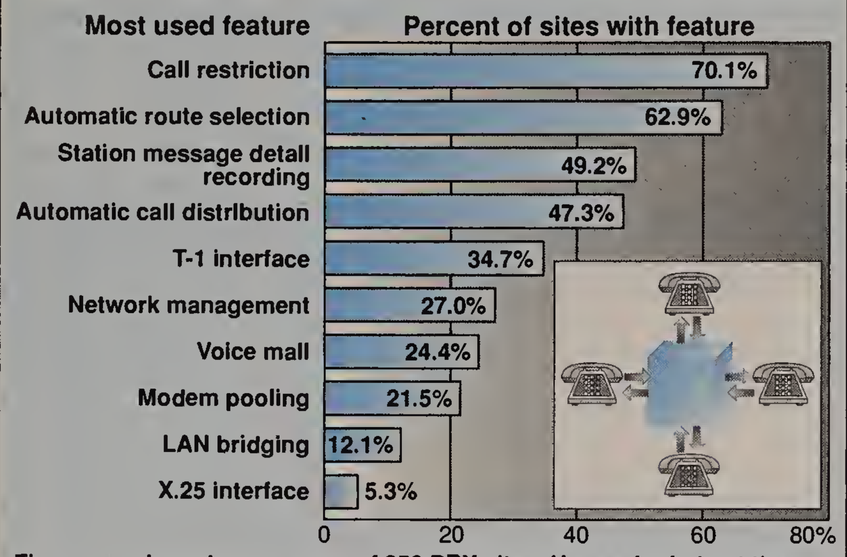
The clear-channel 64K bit/sec capability is offered as an optional feature to new subscribers. Current fractional T-1 customers that want to upgrade their circuits to support 64K bit/sec must pay a onetime circuit reengineering charge per company, which is typically less than $500, according to a WTG spokesman.

WTG's fractional T-1 service enables users to buy 64K bit/sec channel bundles to achieve link speeds of 128K, 256K, 384K, 512K and 768K bit/sec.

The carrier runs a 21,000 route-mile fiber and digital microwave network.

WTG is one of a handful of carriers, including AT&T, US Sprint Communications Co. and Cable & Wireless Communications, Inc., that offers fractional T-1 service.

PBX feature usage trends



Figures are based on a survey of 350 PBX sites. Users singled out the above-mentioned features as likely additions to their PBXs and said they want to equip their switches with ISDN Primary Rate Interfaces and ISDN station equipment.

GRAPHIC BY SUSAN SLATER SOURCE: TFS, INC., WESTFORD, MASS.

City replaces leased lines with flexible ISDN links

Colorado Springs plans to use ISDN for voice.

By Bob Brown
Senior Editor

COLORADO SPRINGS — The city of Colorado Springs said it hopes to save up to $50,000 a year by replacing leased data lines with Integrated Services Digital Network facilities.

The ISDN services will be used initially to support customer service representatives in the city's utility department and a network supporting a Sun Microsystems, Inc. distributed data base. But later this year, the city plans to begin using ISDN to integrate data and voice at various city offices.

The city, which signed up for US West, Inc.'s ISDN Basic Rate Interface (BRI) service last November, has installed 33 BRI lines so far. It plans to increase that number to 90 by April and may eventually install as many as 200 BRI links.

"We're going to grow into ISDN," said Carroll Clabaugh, the city's information systems director. It does not, for example, plan to use ISDN for voice until the price of voice terminal equipment comes down, he said.

Colorado Springs plans to use ISDN to replace about 90% of its 60 leased data lines at some 26 locations.

Most of the data lines — which run at 2,400 to 9.6K bit/sec — are used to tie about 600 assorted Unisys Corp. personal computers and terminals at multiple city offices to a utility department Unisys mainframe at the city's data center.

Colorado Springs owns and operates its own electric, gas, water and waste water utilities, and it uses the mainframe to handle thousands of customer billing transactions daily.

Ironically, it may still be a while before the 64K bit/sec ISDN lines are used for higher speed communications here since the terminal controllers on the net only support up to 9.6K bit/sec, said Bob Kelso, the city's telecommunications manager.

But switching to ISDN now makes sense since the switched service is less expensive and more flexible than leased lines and provides a way to add voice as well, he said.

"You figure that ANI can cut 12 to 15 seconds [off each] call by bringing a customer's files up on a terminal screen right away. [If] you multiply that by 1,000 calls per day, that makes ANI attractive," Kelso said.

While the city has grand plans for using ISDN, only its new graphics-oriented Sun network will immediately take advantage of the twin 64K bit/sec channels available in each BRI link, Kelso said.

The Facilities Information Management System (FIMS) network, which swings into action this month, supports a data base that includes digitized aerial photographs of the city and related information about the city's utility facilities, buildings, streets and other infrastructures.

The net currently consists of 14 Sun workstations scattered throughout the city that are tied to one another as well as to a primary file server via ISDN links.

The FIMS network is designed to provide city employees with a variety of applications, including the creation of digitized maps that can be used for analysis.

(continued on page 10)

Oil exec details trials of installing T-1 net

ENTELEC president shares lessons learned from Marathon Oil's extensive network upgrade project.

By Bob Wallace
Senior Editor

SAN ANTONIO, Texas — Installing a T-1 network can test your patience, as staff members at Marathon Oil Co. can affirm.

David Hoxworth, a telecommunications engineer at the company, told 150 users at the Energy Telecommunications and Electrical Association's (ENTELEC) recent conference here how he contended with a protracted evaluation, carrier selection and installation process while upgrading a tandem tie-line network to an eight-node voice/data T-1 backbone.

"The only preparation I had was a general knowledge of what a T-1 circuit was, how multiplexers function and general project work," said Hoxworth, who is also president of ENTELEC. "I basically started from scratch and learned as I went."

Before the upgrade, the company operated a tandem tie-line network consisting of two point-to-point T-1s and an intricate web of multidrop private lines leased primarily from AT&T.

The company launched a network design and optimization study in 1987 to evaluate the idea of replacing the net with virtual network services. The company looked at services from the top three carriers, including an AT&T proposal for a hybrid network based on its Enhanced Private Switched Communications Service (EPSCS) and its Software-Defined Network (SDN) service.

USX Corp., Marathon's parent company, was an EPSCS user and encouraged the oil firm to choose a similar network. But Marathon decided to broaden its study to include T-1 networking and found that a T-1 net would save the firm roughly $37,500 a month more than the best virtual net option, the EPSCS-SDN hybrid.

But convincing management that T-1 was the way to go was another matter.

"Marathon, being a fairly conservative company, was some-

(continued on page 10)

WASHINGTON UPDATE

BY ANITA TAFF

AT&T to offer three Megacom 800 promos. AT&T last week filed three promotions for its Megacom 800 service with the Federal Communications Commission.

The first promotion offers to waive the service establishment charge, T-1 central office connection installation charges and T-1 local channel service charges for customers that sign up for Megacom 800 for at least six months and agree to generate at least $2,500 per routing arrangement, which includes routing by time of day and by day of week, for the period.

Under the second promotion, AT&T will give users a credit equal to one month of domestic Megacom 800 usage when customers order a new 800 number and a new routing arrangement. Customers may choose any of the first six months of bills for the credit. Credits may not exceed $1,000 and are limited to 10 credits per customer.

The offer will be open only to customers in 14 states: Alabama, Arkansas, Florida, Georgia, Kansas, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, South Carolina, Tennessee, Texas and Oklahoma. Customers must sign up for a six-month term.

The third promotion will provide customers in the central U.S. with a credit equal to 30% of one month's billing when they contract for a new routing arrangement. The credit may not exceed $500 and is limited to 10 per customer. Customers must sign up for six months.

Customers in Illinois, Indiana, Iowa, Michigan, Minnesota, Nebraska, North Dakota, Ohio, South Dakota and Wisconsin are eligible for the promotion. All three promotional offers are scheduled to take effect April 1 and run through June 29. Customers must complete installation by Aug. 29.

City replaces ines with ISDN

ontinued from page 9

According to Kelly Means, inegrated MIS manager for the ity's utility department, the IMS net will likely require even nore bandwidth than Basic Rate nterface can provide because the et is so graphics-oriented.

"ISDN came at a great time for us," Means said. "But it may not be long before we will look at other alternatives for higher speeds."

LU 6.2 link

Currently, the city is working to connect the Sun network to an IBM 4381 mainframe at the city's data center via an ISDN link, said Tom English, lead communications specialist for the city's Information Systems Department. The link would support IBM's LU 6.2 protocol so that applications on the host could communicate directly with applications on the Sun net, he said.

The ISDN project, including up-front costs for installation charges, ISDN customer premises equipment and associated costs, will cost about $160,000, Kelso said.

Oil exec details trials of T-1 net

continued from page 9

what reluctant to move into an entire network built on T-1 technology," Hoxworth recalled.

Although the basic functionality would not change by upgrading to a T-1 net, management had to come to grips with the idea of putting all its eggs in one basket," he said. The final approval for the T-1 project was finally given two months later, Hoxworth said.

When the carrier selection process began, Hoxworth sent a set of specifications and a list of locations to six different carriers, including AT&T, MCI Communications Corp., US Sprint Communications Co. and Williams Telecommunications Group, Inc. (WTG).

The project team specified that the T-1s support the extended superframe format and meet an AT&T technical reference delineating acceptable T-1 circuit performance. "We specified that the circuits be more reliable than was specified in the document," Hoxworth said.

The company eventually narrowed the field to WTG and US Sprint, but AT&T reduced its T-1 rates before Marathon selected the winning vendor. Each carrier lowered its pricing in response to the AT&T rates, but every time a contending carrier changed its pricing, Hoxworth's team had to spend several days running the rates through its optimization model.

Although the competition was productive — each carrier ended up shaving 25% off the rates first proposed — the movement back and forth delayed the project by roughly two months, he said.

Each time Hoxworth's team thought the options were stable, someone would come up with a better deal to consider, he said. "Obviously, this is not a process you want to inhibit, but it managed to push our schedule into the holiday season," Hoxworth recalled.

Eventually Marathon awarded the contract to AT&T, in part because the carrier agreed to make its Findlay, Ohio, central office a T-1 point of presence (POP). Without that concession, Marathon would have had to absorb the cost of linking its Findlay headquarters to the nearest long-haul carrier POP.

"Having a T-1 POP across the street reduced Marathon's access costs for the five circuits coming into the town from $2,500 each to $700 each," Hoxworth said. AT&T also agreed to establish a T-1 POP in Olney, Ill., to serve the Marathon office there.

The company was able to further reduce its costs by buying its T-1s under a volume discount plan USX had with AT&T, he said.

Once the AT&T circuits were installed, Marathon got one of its last surprises. "Some of the testing we were told would be done upon installation wasn't done as expected," Hoxworth said. Some of the circuits did not work.

In the 3½ months since the network was brought on-line, Marathon has had 71 separate outages, ranging in length from a few seconds to hours, Hoxworth said. "But the bottom line is the net is working. It's operating well, and we've saved more money than we thought possible."

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See the FAXNeT Form on Page #46

DATA COMMUNICATIONS

PRODUCTS, SERVICES, ARCHITECTURES, STANDARDS AND NETWORK MANAGEMENT

Worth Noting

> "Banking today is not based on technology and networks. Banking today *is* technology and networks."
>
> **Richard Oliver**
> Senior vice-president
> Federal Reserve Bank of Atlanta

Data Packets

General DataComm, Inc. recently announced that the Integrated Services Digital Network Primary Rate Interface (PRI) for its Megamux Transport Management System (TMS) T-1 multiplexer has passed AT&T compatibility tests.

The testing ensures that Megamux TMSs equipped with PRI will be able to access switched ISDN services via a dedicated T-1 access circuit.

A battery of tests conducted in Holmdel, N.J., and Washington, D.C. verified that General DataComm's PRI fully complies with the CCITT Q.931 standard for call signaling on the D channel.

The tests also confirmed that the PRI implementation will support data or voice transmission on the B channels, as well 384K bit/sec bandwidth over high-capacity channels.

Adding support for PRI to Megamux TMS will give private net users the ability to route traffic around a failed T-1 circuit in the private net to the switched ISDN network. This gives users an alternative to leasing costly redundant T-1 circuits to support rerouting.

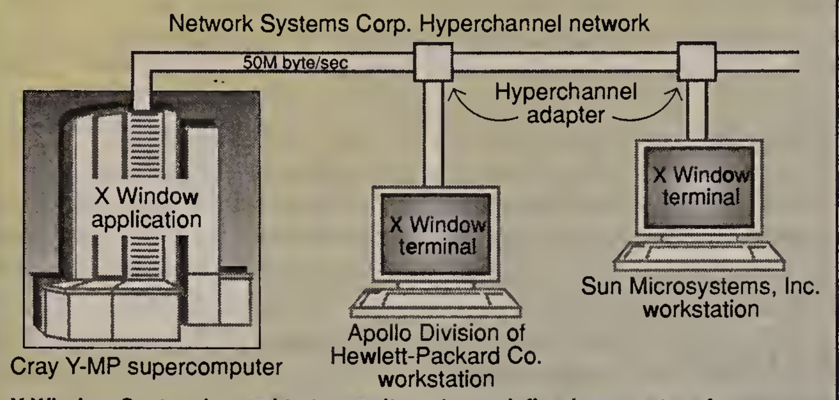
Megamux TMS users with PRI can also use a T-1 access line to establish dial-up 384K bit/sec circuits on an ISDN network. That bandwidth can be used for such applications as traffic rerouting and high-quality videoconferencing.

Network Systems Corp. recently announced that its line of bridges and routers has been enhanced to provide links between remote Ether-

(continued on page 12)

Boeing's windows into Cray

X Window will simplify interaction with the mainframe and speed design analysis.


Network Systems Corp. Hyperchannel network
50M byte/sec
Hyperchannel adapter
X Window application
X Window terminal
X Window terminal
Cray Y-MP supercomputer
Apollo Division of Hewlett-Packard Co. workstation
Sun Microsystems, Inc. workstation

X Window System is used to transmit engineer-defined parameters for a design analysis to the Cray Research, Inc. Y-MP and return the results to X Window workstations, which generate the resultant image. Without X Window, engineers have to build batch files that contain the parameters for the analysis and then download the results, a process that is slower and more complicated.

GRAPHIC BY SUSAN J. CHAMPENY SOURCE: THE BOEING CO., BELLEVUE, WASH.

Boeing to use X Window to achieve design efficiencies

Technology will support client/server applications.

By Jim Brown
Senior Editor

BELLEVUE, Wash. — The Boeing Co. recently purchased a Unix-based Cray Research, Inc. Y-MP supercomputer it will use to support X Window System-based airplane design applications.

Using X Window to support client/server relationships between workstations and the $20 million Cray Y-MP instead of the traditional method of batch processing design applications will make it easier for engineers to submit processing jobs and reduce the time it takes to get results.

For instance, X Window will enable engineers to access computational fluid dynamics applications directly on the Cray Y-MP and enter the parameters needed to run simulated tests of airplane aerodynamic, propulsion and structural designs. X Window makes it possible to display the results of those tests automatically on the engineer's graphical workstation.

Today, engineers must upload test parameters from their workstations to the company's existing Cray X-MP. The Cray X-MP processes the tests one at a time, which means engineers must wait until tests being conducted by other engineers are completed before their tests can be run.

This also forces engineers to keep checking the Cray X-MP to find out when their tests have been completed, after which they must manually download a file to view the results.

Adding support for X Window to the workstations and adding the new Cray Y-MP also paves the way for Boeing to build a distributed computing environment in which workstations are transparently tied to larger systems, including the Cray Y-MP.

The Cray Y-MP, which will run Cray's Unicos implementation of AT&T's Unix System V with Berkeley Software Distribution 4.3 extensions, will reside on a Network Systems Corp. Hyperchannel local network. The Hyperchannel currently supports the Cray X-MP, Control Data Corp. Cyber supercomputers and IBM mainframes.

Unix-based workstations from Sun Microsystems, Inc., Hewlett-Packard Co.'s Apollo Division and IBM are linked to the Hyperchannel via Hyperchannel adapters. Remote Ethernets supporting Unix-based workstations are attached via T-1 bridges.

> Using X Window will make it easier for engineers to submit processing jobs.

▲▲▲

Before X Window can be implemented, Boeing's various engineering groups must port applications running on the X-MP under the Cray Operating System to Unicos, which could take up to two years, said Joseph Kranak, manager for Boeing's Cray X-MP service.

Although time-consuming, the task will not be too complex since application compilers used with Cray Operating System and Unicos are similar, said Robert Bedoll, project manager for installing the Y-MP. "It's not an exceptionally complex matter to

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Unix winning points in commercial sector

Standard gains wider acceptance thanks to its ability to support peer-to-peer communications.

By Jim Brown
Senior Editor

Unix-based systems are increasingly finding their way into the networks of private industry, due in large part to networking features in the operating system that enable users to build client/server and distributed computing applications.

Long a mainstay in the networks of the academic and scientific research community, Unix is being accepted by users in the commercial sector for its proven ability to run network-based applications that support peer-to-peer communications in an open computing environment.

One of the features prompting commercial users to examine Unix more closely is the Network Computing System (NCS) developed by Hewlett-Packard Co. Announced in 1987, NCS enables programmers to write Unix-based applications capable of parceling out computationally intensive tasks to other network machines.

In addition to NCS, the application programming interfaces (API) supported under Unix, such as Berkeley Software Distribution's Sockets and AT&T's Unix Streams, make it easy for developers to build cooperative processing applications. Sockets and Streams enable applications running on the same Unix system or on different Unix systems to communicate as peers.

"This is one area where Unix excels over what IBM is doing," said Randall Nagy, a software consultant with the Buffalo, N.Y.-based Computer Task Group/Telecommunications Management Corp.

> One of the features prompting commercial users to examine Unix more closely is NCS.

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IBM's Advanced Program-to-Program Communications and LU 6.2 protocols cannot match the functionality of Sockets and Streams, Nagy said. "A Unix net-

(continued on page 12)

Japanese shipping firm buys Infotron T-1 muxes

By Joe Panepinto
Staff Writer

CHERRY HILL, N.J. — An international shipping company based in Japan is migrating all of its voice and data traffic onto a T-1 backbone based on 12 newly purchased Infotron Systems Corp. Infostream NX3200 T-1 multiplexers.

The network will allow Kawasaki Kisen Kaisha, Ltd. (K-Lines) to track containers better worldwide and reduce costs by integrating voice and data traffic onto a single digital net dubbed the K-Lines Intelligent Global Network System (KINGS) net.

The T-1 network is replacing a variety of voice, telex and facsimile facilities used to relay information on the whereabouts of customers' packages.

Infotron is also installing and configuring the multiplexers for K-Lines, a worldwide shipping company based in Kobe, Japan.

K-Lines paid $1.1 million for the Infostream NX3200 T-1 multiplexers and the Infotron services, which will give the shipping company full matrix-switching capabilities.

The KINGS network supports voice and data traffic over a backbone of private T-1 circuits linking five K-Lines North American sites.

This summer, it plans to provide a U.S.-to-Japan link over the Hawaii-4/Trans-Pacific Cable-3 fiber-optic cable.

Sites currently supported by the KINGS net are located in Chicago; Cranford, N.J.; Hong Kong; Houston; Long Beach, Calif.; San Francisco; Singapore; and Tokyo. The company plans to expand the net to include nodes in Atlanta; Seattle; Taipei, Taiwan; and Toronto.

Net management services will be provided by Infotron's Integrated Network Manager and concentrated in Cranford, San Francisco and Tokyo.

Boeing to use X Window to achieve

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move applications from the batch Cray to the Unix Cray," he said. "The complexity comes in restructuring programs to take advantage of the capabilities that Unix provides, like X Window and distributed computing."

Windowing and display services

In the X Window environment, X Window software running on workstations provides windowing and display services for X Window applications running on the host.

For example, X Window protocols are used to transmit a set of engineer-defined parameters for a design analysis test to the Cray Y-MP to see how a wing design will perform under certain atmospheric conditions. The Cray Y-MP performs calculations and returns a result to the workstation, which then creates an image depicting what would happen to the wing if it encountered the specified conditions.

"The engineer can run a single test case with a certain set of parameters and view the results almost instantly," Bedoll said. "Then the engineer could alter parameters, run another test and view those results almost instantly."

With the older batch processing method, it can take hours for engineers to prepare, submit and wait for batch jobs to be processed. X Window "significantly shortens the period to do a design analysis," Bedoll said. "The goal is to talk about waiting minutes instead of hours."

Once X Window is implemented, Boeing will begin building distributed applications that are based on either Apollo's Network Computing System or the Open Software Foundation's emerging distributed computing technology.

These technologies will make it possible for software running on the workstation to determine if a specific task should be performed locally or whether it should be routed to a network-attached processor better suited to the task.

> "The engineer can run a single test case with a set of parameters and view the results almost instantly."

▲▲▲

This will obviate the need for engineers to know how to log onto the host with the appropriate X Window applications necessary to complete a design analysis.

"The gains in productivity will hopefully be enormous," Bedoll said. "We're not there yet, but it is a Holy Grail of computing for all companies." ☒

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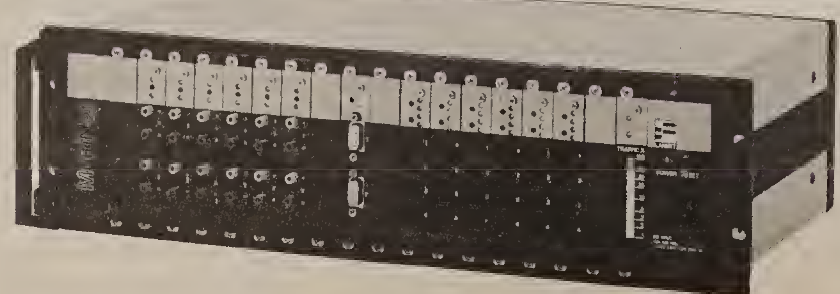

See the FAXNeT Form on Page #46

Unix winning points in commercial sector

continued from page 11

work is right now much more of a cooperative processing network than an IBM local-area network can ever be."

NCS coupled with the Sockets and Streams APIs are enabling the commercial sector to use Unix to build network-based applications that support software development, financial investment tracking and computer-aided engineering.

"Unix has gotten to the level where the commercial sector can start doing something with it," said Steven Levy, vice-president and quantitative analyst with Putnam Companies, Inc. in Boston.

Putnam is currently building a Unix-based application development tool that will simplify the development of distributed applications.

The first application built with the tool gives financial analysts using DOS-based microcomputers transparent access to data stored on Unix devices ("Distributed application tool pays off for Putnam," *NW*, Feb. 5).

NCS, Sockets, Streams and other Unix networking features — such as Sun Microsystems, Inc.'s Network File System — are built on top of communications facilities that were part of early versions of Unix developed by AT&T.

"Over the last 10 years, Unix and networking have gone hand in hand," said W. Ross Burrus, engineering specialist with Martin Marietta Energy Systems, Inc. in Oakridge, Tenn.

Design of kernel is key

The design of the Unix kernel, the key component of the operating system, makes it easy for software engineers to add advanced networking functions, analysts said. This has been proven repeatedly.

"The original Unix didn't have any communications capability at all," said David Taylor, president of Intuitive Systems, a consultancy in Mountain View, Calif.

But it didn't take long for software engineers to add a communications feature called Unix-to-Unix Copy Program, which enables Unix users to exchange messages and files over point-to-point, asynchronous links.

Shortly after that, Transmission Control Protocol/Internet Protocol was developed to allow LAN-attached Unix devices to communicate with one another. TCP/IP's use has since become more widespread and now even provides links between Unix and non-Unix devices.

"TCP/IP has become universal at this point," said Dean Harris, senior software development engineer at Melita Electronic Labs, Inc. of Norcross, Ga., which develops telemarketing software for the banking industry.

Harris said his firm is replacing DOS-based servers running Novell, Inc.'s NetWare operating system with Unix-based servers supporting TCP/IP. The Unix servers will support DOS-based microcomputers that application developers use to build telemarketing software.

Melita's DOS-based microcomputers run Locus Computing Corp. software, which enables them to run DOS and Unix concurrently.

Because Unix runs on systems as large as a Cray Research, Inc. supercomputer, it will support network servers that are far more powerful than DOS- or OS/2-based servers, Harris said. Futhermore, because Unix is multiuser and multitasking, users can partition a Unix system to support multiple terminals at the same time it supports network-attached microcomputers. The multitasking OS/2 cannot do this, he said.

Pros and cons of Unix networking

Pros

- ➕ Eases development of client/server and distributed computing applications.
- ➕ Supports common application programming interfaces.
- ➕ Runs on a wide range of processors, from microcomputers to supercomputers.
- ➕ Supports TCP/IP.

Cons

- ➖ Inherent complexity makes it difficult to master.
- ➖ Requires more expensive processors.
- ➖ Excessive cost and performance for simple applications.

SOURCE: NETWORK WORLD, INC., FRAMINGHAM, MASS.
GRAPHIC BY SUSAN SLATER

However, the network benefits of Unix do not come without trade-offs, users said. Unix requires the use of more expensive processors that may be overly powerful for typical business applications such as word processing and spreadsheets.

"In many commercial environments, Unix is not the preferred platform," Burrus said. Unix is better suited for applications such as computer-aided engineering and computer-aided design, which require powerful processors to display intricate graphical images.

But probably one of the major drawbacks keeping Unix from making more inroads into commercial user networking plans is its complexity. "The one thing I found out about Unix is that there is a big learning curve," Harris said. ☒

Data Packets

continued from page 11

nets running Xerox Corp.'s Xerox Network Systems, Novell, Inc.'s Internetwork Packet Exchange/Sequenced Packet Exchange (IPX/SPX) and 3Com Corp.'s local-area net protocols.

Previously, Network Systems' EN 610 and EN 620 products provided links between remote Ethernets running Transmission Control Protocol/Internet Protocol and Digital Equipment Corp.'s DECnet. Both the EN 610 and EN 620 link Ethernets over wide-area net connections operating at speeds from 1,200 bit/sec to T-1 speeds. The products are made by Wellfleet Communications, Inc. and are sold by Network Systems under an OEM agreement.

In bridging applications, the products can pass up to 14,000 packet/sec between Ethernets. The built-in router function enables the products to route up to 8,000 packet/sec between remote Ethernets. The products also support the Simple Network Management Protocol (SNMP) and can be controlled via a Sun Microsystems, Inc. 3/50, 3/60 or SPARCstation running the Network Systems-SNMP Management Software.

Support for the Xerox, Novell and 3Com protocols will be included with all new EN 610s or EN 620s. Current users can upgrade free of charge. An EN 610 or EN 620 supporting one Ethernet connection and one T-1 interface costs $8,900. ☒

LOCAL NETWORKING

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Worth Noting

Worldwide global shipments of bridges, routers and brouters totaled 27,000 in 1989, bringing the installed base to 65,000. Digital Equipment Corp. led the market with 21% of last year's shipments, followed by 3Com Corp. with 11% and Vitalink Communications Corp. with 10%, according to a recent survey by International Data Corp. in Framingham, Mass.

Netnotes

Network Applications Technology, Inc. recently announced its LANB/200 Remote Ethernet Bridge to connect Ethernets over high-speed synchronous data lines.

The bridge supports Ethernet connections to T-1, fractional T-1 and European T-1 (2.048M bit/sec) lines.

While LANB/200 costs $2,995, the company is also offering a version that supports only 64K bit/sec speeds for $1,995.

For more information, contact Network Applications Technology at 21040 Homestead Road, Cupertino, Calif. 95014, or call (408) 733-6478.

Hughes LAN Systems recently added support for the Simple Network Management Protocol to its 8080 Ethernet Bridge and 8011 WAN Bridge, making it possible to remotely manage the networks being bridged.

There is also a protocol filter that can be used to block traffic by its protocol type.

The 8080 Ethernet Bridge costs $2,495, and the 8011 WAN Bridge is priced at $3,995.

For more information, write to Hughes LAN Systems, 1225 Charleston Road, Mountain View, Calif. 94043, or call (415) 966-7300. ◼

Pacer unveils software for Macs to access Ultrix hosts

Packages offer file, print and message services.

By Laura DiDio
Senior Editor

LA JOLLA, Calif. — Pacer Software, Inc. last week introduced a suite of software products that enable Apple Computer, Inc. Macintoshes on Ethernets to exchange files and electronic mail messages with Digital Equipment Corp. VAXes running the Ultrix operating system.

The three new packages — PacerShare, PacerLink and PacerPrint — enable Macintosh users on Ethernets to access file and print services transparently on VAXes and DEC's new DECServer. Ultrix is DEC's implementation of the Unix operating system.

The new software will also enable Macintosh users to exchange E-mail with Ultrix users, said Jeff Blum, Pacer's director of business development.

Also, PacerLink supports file transfer and E-mail between Macintosh Ethernet users and other Unix-based systems supplied by Data General Corp. and Sun Microsystems, Inc., Blum said.

"Previously, only a DEC VAX running the VMS operating system or a dedicated Macintosh running the AppleShare network operating system could be used as a server on an Apple network," Blum said.

PacerShare, Pacer's implementation of Apple's AppleTalk Filing Protocol, is file server software that resides on Ultrix computers. The software enables Macintosh users to access VAX Ultrix files by invoking standard Macintosh icon-based commands, Blum said. Those commands trigger a series of predefined actions that set up the communications path to the Ultrix host.

PacerLink allows Macintosh and IBM MS-DOS personal computers on an Ethernet to communicate with Unix and Ultrix hosts and servers. It consists of two modules.

One module resides on Macintosh and IBM MS-DOS-based computers on an Ethernet. It establishes emulation sessions for nine terminal types, including DEC's VT-100, VT-220, VT-240 and VT-241. It also performs file transfers and print spooling, which lets users print local files to a Unix or Ultrix server or host printer.

The second PacerLink module resides on either a Unix or Ultrix host or server. It receives and executes print commands from the workstations and performs necessary binary and text file translations between the server and the users' workstations.

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SynOptics adds token-ring support to LAN wiring hub

By Walter Sweet
West Coast Correspondent

MOUNTAIN VIEW, Calif. — SynOptics Communications, Inc. last week unveiled a token-ring interface for its LattisNet System 3000 smart wiring hub that allows it to support token-ring LANs in addition to Ethernets.

The new LattisNet Token Ring product will enable network administrators to maintain control of traffic, security and growth on token-ring and Ethernet local-area networks from a single wiring concentrator, the company said.

LattisNet Token Ring is a group of products, including a token-ring interface and host module supported only on the company's high-end System 3000 concentrator, which previously only supported Ethernets.

SynOptics' announcement of its LattisNet Token Ring interface marks the company's first foray into the token-ring market. The move will be followed by the introduction of bridges, routers and network management software by year end, the company said.

Until these products ship, users will be able to link various local token-ring nodes into the concentrator or use third-party bridges to link to another token-ring net.

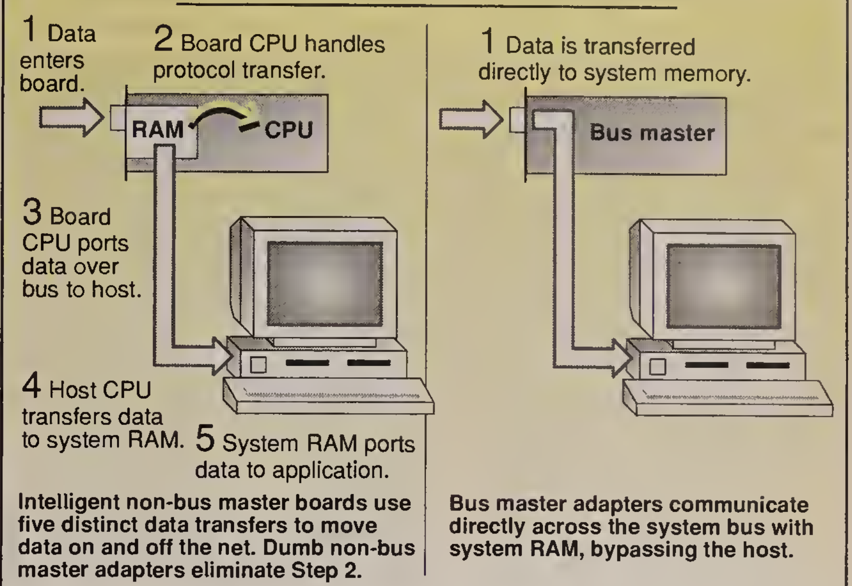
"We're going into token ring because there are customers we haven't been satisfying by offering just Ethernet products," said Michael Clair, vice-president of marketing and sales for SynOptics.

Growing market

Clair said there are about one million token-ring nodes that are going to be installed this year and this is a growing market that the company can't ignore.

(continued on page 14)

Bus mastering and net I/O


1 Data enters board.
2 Board CPU handles protocol transfer.
RAM
CPU
3 Board CPU ports data over bus to host.
4 Host CPU transfers data to system RAM.
5 System RAM ports data to application.
1 Data is transferred directly to system memory.
Bus master

Intelligent non-bus master boards use five distinct data transfers to move data on and off the net. Dumb non-bus master adapters eliminate Step 2.

Bus master adapters communicate directly across the system bus with system RAM, bypassing the host.

GRAPHIC BY SUSAN J. CHAMPENY SOURCE: COGENT DATA TECHNOLOGIES, INC., FRIDAY HARBOR, WASH.

Bus masters prolong life of PC AT servers

Net adapters crank up server I/O performance by commandeering bus and porting data to memory.

By Susan Breidenbach
West Coast Bureau Chief

SAN FRANCISCO — As LAN users contemplate investing in the new superservers that are hitting the market, a relatively unknown class of network adapters is squeezing extra performance out of existing file servers based on IBM's AT bus architecture.

These adapters act as bus masters, taking control of the AT bus for short bursts and transferring data directly between the local-area network and the workstation's system memory.

Bus master boards bypass the server's CPU, eliminating several memory-to-memory data transfers. This increases network I/O performance and improves response times for users.

Bus mastering technology is generally associated with IBM's Micro Channel Architecture (MCA) or the more recent Extended Industry Standard Architecture (EISA). Even today, some board manufacturers insist that the AT bus does not support bus mastering.

However, the original IBM technical reference manuals for the AT describe bus mastering, and — while IBM itself never really exploited the technology or encouraged others to do so — third-party vendors such as Cogent Data Technology, Inc., Madge Networks, Ltd. and Proteon, Inc. have used it to design the high-performance network adapters that have started selling like hotcakes in recent months.

"Sales of our AT bus master boards tripled between January and February this year," said Charles Anderson, president of Cogent.

Simply put, bus mastering provides the fastest way to transfer data from the network to system memory. And it does more than transfer data faster: Because the system CPU is bypassed, it is free to perform other tasks.

"Our token-ring bus master boards achieve full-bandwidth transfer at 4M or 16M bit/sec and only take 12% of the resources of the file server CPU," said Ed Murray, director of North American operations at Madge Networks. "That's incredibly low. Without bus mastering, the best we were getting was 71% to 92%."

Bus master boards are more expensive than their non-bus master counterparts. While prices for non-bus master Ethernet boards start at less than $300, Madge Networks' Smart 16/4 Ringnode token-ring adapter lists for $895, as does Cogent's E/Master II Ethernet board.

What users are getting for the extra money is performance. When multiple bus master boards are used in a server, network I/O can be cranked up so that data throughput plus network protocol overhead equals the full network bandwidth. Cogent, for example, has demonstrated data throughput of 2.5M byte/sec with three of its E/Master II boards in a server.

When taking network protocol overhead into account, this rate amounts to saturation of Ethernet's 10M bit/sec speed. By contrast, traditional non-bus master Ethernet adapters can use only 10% to 40% of that bandwidth.

In implementing the AT architecture, some AT clone manufacturers cut corners, doing only

(continued on page 14)

Bus masters prolong life of PC AT servers

continued from page 13

enough to ensure compatibility with IBM's machines and eliminating elements crucial to bus mastering transfers. The major brand-name vendors, such as Compaq Computer Corp., either support AT bus mastering already or are making the enhancements to do so, Murray said.

Another problem stems from the fact that the AT architecture doesn't provide a good scheme for arbitrating between multiple bus master expansion cards for possession of the bus. It is possible for one bus master board to hog the bus and even to hold it long enough to interrupt the system's memory-refresh cycle and, consequently, wipe out the memory.

Various manufacturers have come up with solutions to this problem. Cogent can put a total of four of its bus master boards into an AT-class machine using the "cascade mode" of the Direct Memory Access (DMA) controller on the motherboard to mediate between them. The DMA controller receives requests for memory access from the boards and passes them on to the system CPU, which relinquishes control when it can. The controller can be programmed to turn the bus over to the various cards on a rotating or fixed basis.

Madge Networks has taken a different approach, supporting up to two of its token-ring bus master adapters in one machine by ensuring that neither can hold the bus for more than half of the system's memory-refresh cycle. The probability that they will consecutively hold the bus for exactly two halves of the same memory cycle are virtually nil, Murray said.

Because there is no standard scheme for supporting multiple AT bus masters, there is some risk in mixing boards from different vendors on the same system. The cards might be making conflicting assumptions about their rights to the bus.

Still, vendors regard AT bus masters as interim solutions for the network server market. The future belongs to the MCA and EISA technologies. "Both MCA and EISA provide a much better platform for bus mastering," Murray said. "They are higher speed buses with a 32-bit bandwidth, and the ability to handle multiple bus masters is designed into their architecture."

Pacer unveils software for Macs

continued from page 13

The third product, PacerPrint, is print server software that resides on any VAX Ultrix system. It enables both Macintosh and Ultrix terminal users on the same Ethernet to print files to PostScript printers. It also lets Ultrix and Macintosh users share a single printer. Previously, Macintosh users could only share printers with VAX VMS machines.

Ultrix advantage

As a replacement for a dedicated Macintosh server, Unix- and Ultrix-based servers provide several benefits, according to Blum.

They let users double the number of Macintoshes on a server, from 50 on a dedicated Macintosh server to about 100 on an Ultrix-based host. "The new software saves users money because they end up having to buy fewer Macintoshes to dedicate as LAN servers," Blum explained.

The Pacer software packages also enable Macintosh users to take advantage of the advanced security features of the Ultrix environment, such as user, logon, password, group, read, write and execute restrictions.

"The Ultrix environment offers users far greater security than what is currently available to users in Apple's AppleShare world," Blum added. "Network administrators can restrict access to files based on read, write and execute facilities."

According to Blum, Pacer is targeting general Fortune 1000 business users that have both DEC VAX systems and Apple Macintosh LANs installed at their sites, including users in the insurance, banking and aerospace industries as well as communications vendors.

PacerShare and PacerLink cost $1,200 each for a five-user license, or users can buy a five-user license for both products for $2,000, Blum said. PacerPrint costs $1,000 for a version that runs on a single DEC VAX running Unix, while an unlimited printer license costs $4,000. PacerShare, PacerLink and PacerPrint are available now.

Pacer plans to port PacerShare and PacerPrint to other Unix hardware platforms including Data General, Sun and Interactive Systems Corp. machines by this summer, Blum said.

SynOptics adds support to hub

continued from page 13

Each System 3000 backplane supports the connection of two 4M bit/sec or 16M bit/sec token-ring LANs running over shielded twisted-pair wiring.

In addition, the LattisNet Token Ring interface allows users to attach up to 12 token-ring nodes onto each board in the concentrator via standard RJ-45 connections. SynOptics is also offering the SynOptics Token Ring Model 3552 Ring-In-Ring-Out Module, which connects token-ring interfaces into a network of up to 260 nodes.

SynOptics added an automatic ring-wrap feature to the System 3000, which automatically isolates a faulty node on the ring, takes it out of service and routes traffic around it.

LattisNet Token Ring is available now and costs $19,800 for a 132-port connection or $150 per port.

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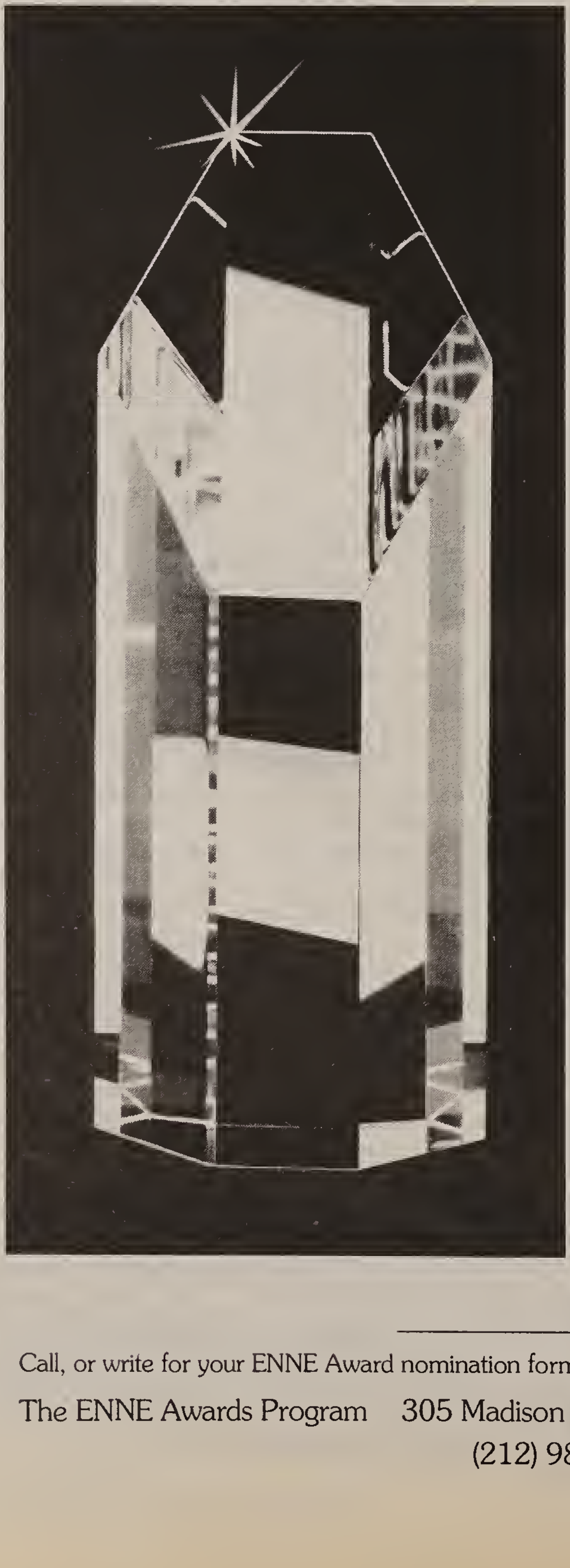

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MANAGEMENT STRATEGIES

MANAGING PEOPLE AND TECHNOLOGY: USERS GROUPS AND ASSOCIATIONS

Worth Noting

"Mainframe managers have to stop ignoring the cowboys down in the LAN world. [Mainframe managers] are the elder statesmen, and we have to get them to impart some of their wisdom to these kids."

Rick Segal
Technical advisor
The Aetna Casualty and Surety Co.
and chairman of the
Council for Network Management
Hartford, Conn.

Association Watch

The **Central New York Communications Association (CNYCA)** will hold a half-day seminar on network planning March 28 at the Holiday Inn in Waterloo, N.Y.

The seminar will focus on issues relating to Open Systems Interconnection and Open Network Architecture.

Annual membership to CNYCA costs $50, entitling the member admission to the seminar series and nine CNYCA newsletters. For more information, contact Connie Smith at (315) 685-4468.

The **Tele-Communications Association, Inc. (TCA)** is looking for 3,500-word papers reflecting the 1990 TCA Annual Conference theme, "Decade of Decisions: Today's Applications, Tomorrow's Opportunities." The conference is scheduled to begin Sept. 24 in San Diego.

The annual call for papers is not limited to TCA members but is open to all individuals interested in the industry. The paper must be an original, unpublished manuscript focusing on design techniques, training and education, applications, regulatory issues, project or strategic planning, or new technologies.

TCA will award $1,000 for the winning entry. Papers are due by May 31. For more information, contact Jo Cavanaugh at (619) 259-5058. ◘

Group urges gov't execs to make better use of IS

GAO directive aimed at clarifying federal IS vision.

By Joe Panepinto
Staff Writer

WASHINGTON, D.C. — A congressional watchdog group based here recently issued a five-tiered directive designed to steer federal information systems (IS) managers toward the more effective use of information technology.

The Government Accounting Organization (GAO) urged managers of government organizations to clarify their visions of the role IS is to play in their agencies' quests to provide improved services to taxpayers and customers.

The GAO claims that a clear vision will reduce the amount of money agencies spend on noncritical IS applications and lead to the establishment of long-term agency IS goals and objectives.

According to GAO estimates, the federal government operates more than 53,000 computer and telecommunications nets and spends about $20 billion each year to modernize IS.

Yet despite the massive yearly influx of cash targeted for system upgrades, government IS managers do a poor job of providing effective leadership, maintaining projectwide communication, identifying customer needs and providing a clear, complete systems plan, the GAO said.

Continued bureaucratic bungling, the GAO said, will increase the possibility that growing taxpayer demand for services will outstrip system capacities and pressure government IS managers to provide more services with fewer resources.

The symposium, called "Meeting the Government's Technology Challenge," included representatives from industry, Congress and government agencies. They called on IS managers at government agencies to create a clear, unified vision of the role IS systems should play in their organizations, thereby clarifying the goals and responsibilities of IS managers and employees.

Once an agency has a clear idea of what IS services it must provide to support its commitment to taxpayers and custom-

(continued on page 16)

GUIDELINES

BY ERIC SCHMALL

Updating job descriptions vital to telecom success

The administrative base of a telecommunications team rests on well-constructed job descriptions. These documents define what will be expected of the telecommunications group, how it will be organized, what it will do and how it will develop.

Unfortunately, most network managers view the work of writing job descriptions as administrative trivia, a loathsome bother that must be periodically endured.

But managers can't expect to develop a professional telecommunications team unless they carefully define job responsibilities and expectations, and assign individuals with matching skills and experience.

A responsible telecom manager uses the job description process to advance his team and the role telecommunications plays in the organization.

However, since the telecom department is often overshadowed by the information systems (IS) department, there's always a temptation to inaccurately label a communications systems programmer — responsible for such things as VTAM, NCP and NetView — as a systems programmer. Similarly, network control technicians get blended in with other computer room operators.

This is irresponsible. The skills and experience needed to manage information transport — whether it is voice, data, image, video or text — differs significantly from IS jobs. Network managers must fight to differentiate the job requirements of their team from other departments.

(continued on page 16)

Schmall is network systems manager for an insurance holding company.

MANAGEMENT PROFILE

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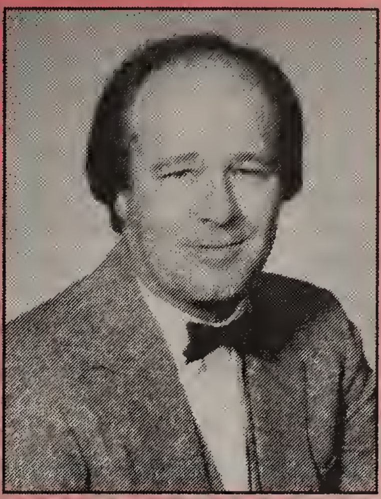

"The biggest task facing the user community is to combat the efforts of the BOCs to seek unreasonable levels of deregulation at the local level."

Brian Moir

- ☐ Legal counsel for the International Communications Association since 1981
- ☐ Partner at Fisher, Wayland, Cooper and Leader, a Washington, D.C. law firm

Moir fights for user regulatory interests

The user community has a lot riding on rulings issued by the Federal Communications Commission. FCC regulatory changes affect everything from service pricing to the fundamental structure of the industry.

One of the pointmen representing user interests before the FCC and other lawmaking bodies in Washington, D.C. is Brian Moir, legal counsel for the International Communications Association, the U.S.' largest group of communications professionals.

Network World Senior Writer Wayne Eckerson recently spoke with Moir about current FCC policies and practices and their impact on business users.

How would you rate this group of FCC commissioners? Are they more or less open to user needs and concerns?

For an FCC that is constantly saying it's trying to defend user interests, their record is less than reassuring. In one of its first major tests, the FCC failed to authorize new interstate access charges for local exchange carriers. All four sectors of the ratepaying community — residential users, business users, long-distance carriers and government ratepayers — spoke with one voice in calling for lower access charges.

Unfortunately, the new commission chose to deny the ratepayers' petition to lower access charges for 1990 by $400 million. The FCC decided to postpone the decision until next year, when it will issue a final plan for capping the prices long-distance carriers can charge. By delaying the decision, the FCC ensures that its price cap plan will look $400 million better than it would have otherwise. For many people who had hoped for something kinder and gentler from this group of commissioners, this has been highly distressing.

Does the FCC have the resources to adequately regulate local carriers and prevent such things as cross-subsidization?

We are deeply concerned that the FCC doesn't have adequate resources to guarantee that ratepayers won't pay excessive interexchange costs. The commission has fewer resources than in the predivestiture era, and its work load has increased.

We know of several cases in which local exchange carriers have overstated costs. Ratepayers shouldn't have to shoulder the cost of the [local exchange carriers'] marketing campaigns for special and switched access services, which exceeds $500 million a year. Where else are users going to get these services, the post office?

This is a form of cross-subsidization that shouldn't be allowed.

In addition, ratepayers are bearing the cost of excessive inside wiring expenses, deferred taxes, and excessive billing and collection costs. We also know that the [local exchange carriers] are devoting excessive resources, both human and financial, to [Modified Final Judgment] litigation, lobbying efforts and public disinformation campaigns.

Is there any danger that AT&T could seriously undermine the competitiveness of US Sprint Communications Co. and MCI Communications Corp. if freed from current regulatory constraints?

The business user community has never asked for flash-cut de-

(continued on page 16)

Moir fights for user regulatory interests

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regulation. If they tailor the level of regulation to the degree of competition that exists in each of the various markets or service categories, then there is little danger AT&T could gain an unfair advantage. The FCC should fully deregulate only those service markets in which there is vigorous competition.

Congress is currently debating legislation that would lift the business restrictions imposed on the local exchange carriers by the Modified Final Judgment. What impact will this legislation have on business users if it becomes law?

The business user community has never opposed changing the MFJ. But we do oppose changes that don't meet the interests of all businesses and ratepayers, not just seven highly profitable companies that face no competition in their primary markets. Unfortunately, we find that the proposal under discussion in the House [of Representatives] better serves the interests of these seven companies than the majority of U.S. businesses.

What can Capitol Hill lawmakers do to improve the way telecommunications policy is formulated?

Users would warmly welcome and support efforts from Congress to oversee the FCC more vigorously. The Congress should spend less of its time evaluating the RBHC's disinformation campaign and more time finding out why the FCC isn't doing a better job or doesn't have adequate resources. It should investigate why interexchange access charges are languishing at unjustifiably high levels and why existing [local exchange carrier] cost structures don't reflect real costs.

What are the major issues on the state regulatory level of which users should be aware?

The biggest task before the user community is to combat the efforts of the RBHCs to seek unreasonable levels of deregulation. This is more difficult to do than at the federal level because there are 51 different forums on the state level that need to be monitored.

Most state incentive-based rate plans appear to create incentives only for carriers. The only incentive they provide ratepayers is to get mad. Most of these plans only favor the interest of the local monopoly, which wants to earn more money.

In competitive industries, advances in technology usually bring lower prices for consumers. In telecommunications, the cost of transmission and switching services has declined significantly, yet these cost reductions haven't been flowing to ratepayers.

Perhaps the local exchange carriers are spending this money to build trans-Siberian fiber companies or to fund their public disinformation campaigns. We don't know. But we have some suspicions.

Group urges execs to make better use of IS

continued from page 15

ers, the GAO suggests it "prepare clear, forward-looking statements articulating the vision."

That vision should focus on customer service, the symposium participants said, and should be supported by a flexible implementation structure.

They also said getting a solid commitment from top management before any IS project is begun would go a long way toward maintaining an agency's vision and holding a systems upgrade project together, from the planning stages through implementation.

To that end, technical managers with direct responsibility for day-to-day net operations should be elevated into higher management positions, they said.

The participants also suggested that agencies make alliances with other agencies in order to garner fresh perspectives on old problems. The alliances can promote more effective in-house communications by bringing together technical and implementation managers in projects generated through the alliance.

But holding a vision together through unforeseen IS ups and downs takes continuity in management staffing, symposium participants said. Consistent turnover in IS project management and key technical positions cripples an agency's ability to maintain a clear IS vision, thereby hampering efforts to improve the overall efficiency of federal IS systems.

Job descriptions vital to telecom success

continued from page 15

Once this identity is established, the manager should work to provide logical links within the telecom family of jobs. This will provide a clear idea of how responsibilities are divided and how career paths may be followed.

Documentation for each job description should contain simple and realistic explanations of the skills required to progress from junior- to senior-level positions. This means including specific references to such things as years of experience needed, course completion, demonstrated proficiency with certain tools and the kinds of progressively complex projects that a person must become involved in to be considered eligible to move up the career ladder.

Writing good job descriptions is an art that takes time and practice to perfect.

If you think a fault-tolerant network will be too expensive, think about what downtime costs.

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See the FAXNeT Form on Page #46

Worth Noting

Rockville, Md.-based Contel ASC last week announced that it has received a $3 million order for more than 30 satellite dishes from the Soviet news agency Tass, which will use the equipment for one- and two-way transmissions of voice, data and facsimile traffic to five continents.

World News

Canada's main regulatory agency, the **Canadian Radio-television and Telecommunications Commission (CRTC)**, recently announced that it is ordering the majority of the country's carriers to drop most of the remaining restrictions on the resale of capacity from dedicated circuits.

Currently, users in Canada are prohibited from reselling capacity on dedicated circuits to other users for the purpose of carrying telephone calls across local exchange boundaries and dumping them onto the public network.

By May 29, this restriction must be dropped by all Canadian carriers except Norwestel, which currently serves the Northwest Territories and the Yukon.

Instead, the CRTC will require users to pay a fee of approximately $170 per month to do this kind of resale. All other forms of resale will remain unregulated.

The CRTC also ordered **Bell Canada**, which serves the provinces of Ontario and Quebec, to refund more than $10 million to its 6.5 million subscribers.

The payment is the final installment of more than $175 million in retribution the carrier was ordered to make as compensation for overcharging its customers for telephone calls in the early 1980s.

ISDN in Europe

ISDN services and applications to be supported by 24 European carriers by the end of 1993.

Outlined in a memorandum of understanding last year:

• Services supported •

- Basic Rate Interface, using a common European standard for connecting terminal equipment to the public network.
- Primary Rate Interface, using country-specific standard for connecting terminal equipment to the public network. Later migration to European standard.
- Interconnection of national ISDN networks via CCITT Signaling System 7.

• Applications supported •

- Unrestricted access to circuit-switched, 64K bit/sec bearer service.
- Circuit-switched 3.1kHz audio over 64K bit/sec bearer service.
- Automatic number identification (ANI).
- Restriction of ANI.
- Group IV facsimile.

According to a 1986 recommendation by the European Commission:

• Implementation goals •

- ISDN available to 80% of Europe's population.

GRAPHIC BY SUSAN J. CHAMPENY

Europe strives for common ISDN by '93

Agreement billed as one of the first efforts to integrate continent's disparate public networks.

By Barton Crockett
Senior Editor

As one of the first steps toward integrating Europe's disparate public networks, 24 carriers are working to support common Integrated Services Digital Network services, standards and applications by the end of 1993.

European Commission officials portray the effort, negotiated under the auspices of a Conference Europeenne des Postes et Telecommunications (CEPT) authorities agreement last year, as one of the first milestones on the road to harmonizing Europe's disparate public networks.

"Unlike the U.S., which grew up with a single network under the Bell system, each European carrier has its own unique history and technical infrastructure," said Herbert Ungerer, a division head for the European Commission's Directorate General XIII for telecommunications, information industries and innovation. "Our goal is to quickly harmonize these differences to support the Common Market, beginning with the newer, advanced services such as ISDN."

In the CEPT memorandum of understanding, carriers from 18 countries agree to support both Basic Rate Interface (BRI) and Primary Rate Interface (PRI) services using common European standards by December 1993 at the latest. The carriers also pledge to interconnect their national ISDN services via CCITT Signaling System 7 (SS7) and to support several domestic and international ISDN applications.

The carriers are also planning to supplement their ISDN BRI and PRI services with broadband ISDN services later in the decade, although no timetable has been established yet for implementing these offerings (see "European carriers plan broadband ISDN strategy," this page).

Out with the old

The memorandum of understanding stipulates that participating carriers phase out older, proprietary versions of ISDN services and implement new ISDN services that conform to European Technical Standards Institute (ETSI) versions of CCITT ISDN standards.

The goal is to give users access to a basic set of domestic and pan-European ISDN applications in every major European country using the same terminal equipment. Moving ISDN equipment between countries should be possible without any modifications, according to the memorandum of understanding.

Currently, this is impossible — not only for ISDN, but for virtually every other public network service in Europe as well. Part of the problem with ISDN is that only five of the 12 Common Market countries have a commercial ISDN offering, according to Kurt Koenig, a European Commission official for Directorate General XIII. Even fewer offer international ISDN services.

Another problem is that those carriers that offer ISDN support only country-specific ISDN standards. This makes it largely impossible to use the same ISDN terminal equipment in different countries, limiting users' ability to leverage volume discounts on equipment purchases.

(continued on page 18)

AT&T to revamp Korean service with digital lines

Carrier also plans to phase out World Connect.

By Barton Crockett
Senior Editor

BASKING RIDGE, N.J. — AT&T last week announced that by year end, it will begin offering digital private-line service to South Korea at speeds up to T-1.

The carrier also said it has initiated a one-month promotional campaign aimed at migrating users from its World Connect international calling service to Megacom with International Calling Capability.

AT&T said it is replacing its current satellite-based analog links to South Korea with digital facilities, including the Hong Kong-Japan-Korea undersea fiber-optic cable scheduled to be cut over in May and new digital satellite facilities scheduled for installation by year end.

Using these facilities, AT&T for the first time will be able to offer T-1 service to South Korea. Currently, the highest speed private-line service AT&T offers to that country is SkyNet 56, which uses modems to transmit data at 56K bit/sec over analog satellite facilities.

AT&T also offers dedicated voice-grade circuits, international direct dialing and Accunet international X.25 packet-switching services.

An AT&T spokesman said that fractional T-1 service to South Korea will be cut over at an undetermined future date.

Megacom promotion

Separately, AT&T promised to waive a onetime $545 Megacom installation fee as well as local-access modification charges for all customers that convert from its World Connect international calling service to Megacom with International Calling Capability by April 20.

> AT&T is replacing its satellite-based analog links to South Korea with digital facilities.
>
> ▲▲▲

AT&T also promised to give World Connect users that make the conversion a onetime credit of $500 toward Megacom usage charges.

Janice Walker, AT&T's World Connect product manager, said the carrier is trying to push its approximately 80 remaining World Connect customers over to the Megacom international calling

(continued on page 18)

European carriers plan broadband ISDN strategy

Despite the current dearth of pan-European narrowband ISDN services, carriers in Europe are already aggressively plotting the introduction of broadband ISDN services across the continent.

European carriers, like many of their counterparts here, are planning to roll out commercial broadband Integrated Services Digital Network services beginning in 1995, after the Consultative Committee on International Telephony and Telegraphy standards are expected to be finalized.

However, European carriers are going further than their American counterparts by planning to build an experimental broadband ISDN network with nodes in virtually every major country on the continent by 1992, according to Frans Casteur, broadband ISDN project manager with the Brussels, Belgium-based Standards Promotion Application Group, the European counterpart to the U.S. Corporation for Open Systems.

European carriers also are teaming up with other vendors and the European Commission to invest more than $1 billion in the Research and Development for Advanced Communications in Europe (RACE) program, a research project dedicated to developing broadband ISDN applications and equipment ("RACE projects to build European data pipelines," *NW*, June 19, 1989).

Same facilities

According to Casteur, the commercial broadband ISDN services that carriers plan to roll out in the middle of the decade will likely be based on the same facilities used in the experimental broadband ISDN network.

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Europe strives for common ISDN by '93

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In the memorandum of understanding, carriers commit themselves to supporting ISDN equipment portability by offering services that conform to an ETSI-defined public network-to-terminal equipment BRI standard, dubbed Normis Europeenne Telecommunications 3 (NET3). This standard is nearly finalized, and carriers should have no problem conforming to it.

Meanwhile, the corresponding ETSI standard for PRI services, NET5, is still far from completion. Some observers predict that the NET5 standard may not be finalized and implemented by carriers until well after the 1993 deadline.

The memorandum of understanding specifically allows for the implementation of national versions of PRI public network-to-terminal equipment standards until the ETSI standard is completed.

The upshot could be that users will not be able to use the same terminals in different countries for PRI services as easily as they are expected to do so with BRI services.

International ANI

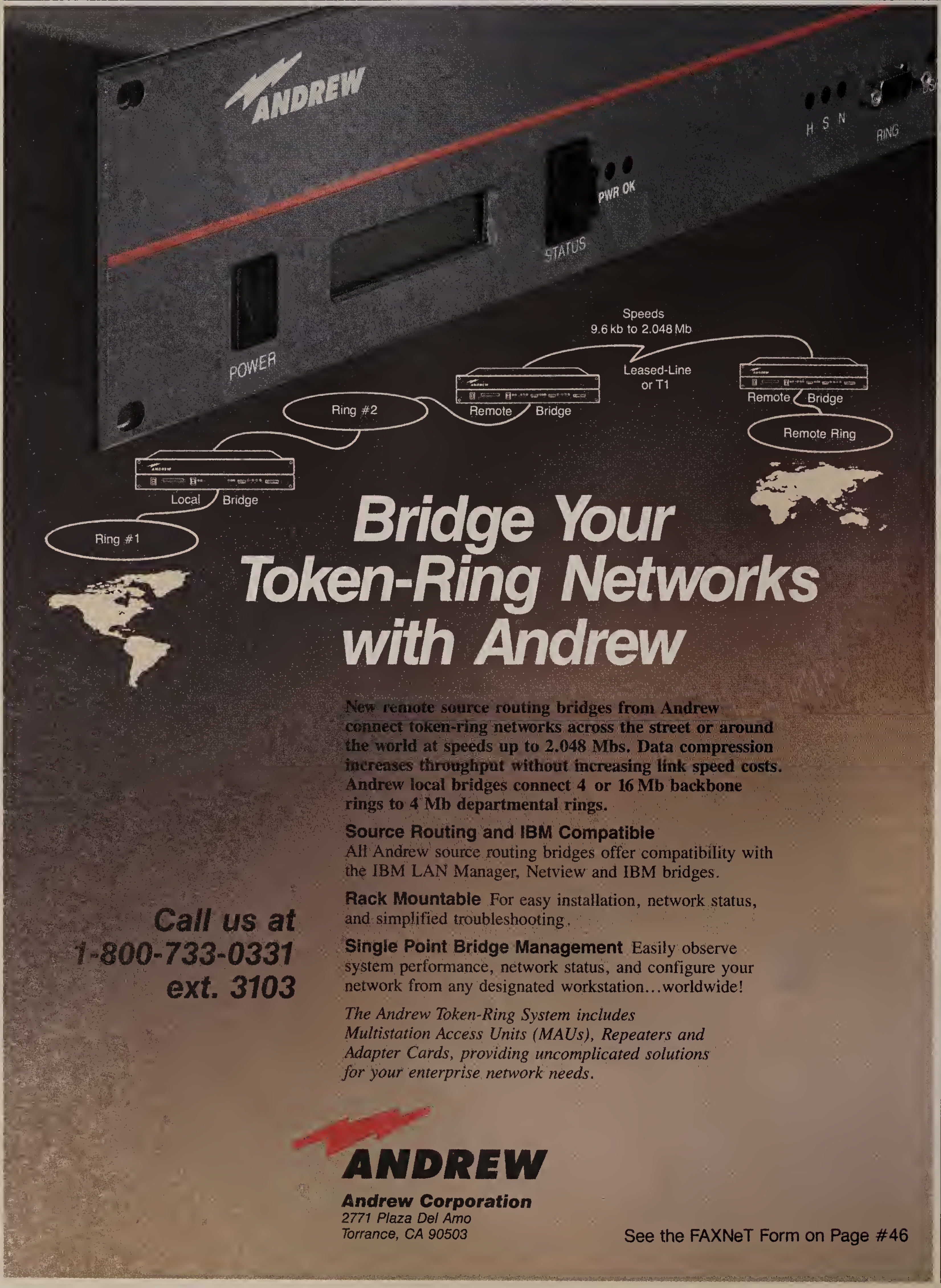
Among the applications required in the memorandum of understanding are unrestricted access to circuit-switched 64K bit/sec services over bearer channels, circuit-switched 3.1 kHz audio service over the bearer channel, automatic number identification (ANI), restriction of ANI, and Group IV facsimile. Each of these applications will be supported over international links.

Other applications are recommended, including switched video services using two 64K bit/sec bearer channels, call forwarding, videotex and conference calling.

The memorandum of understanding does not specify how widely available carriers should make their ISDN services.

In 1986, however, the European Commission issued a recommendation saying that ISDN should be available to 80% of the population of the Common Market by the end of 1993.

Koenig said he expects carriers to strive to meet this goal, although he cautioned that service availability will ultimately be driven by market demand. ◪



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See the FAXNeT Form on Page #46

European carriers plan broadband ISDN

continued from page 17

"The plan is to use this as the basis for a commercial, pan-European, broadband ISDN service," Casteur said.

He explained that carriers are pushing for deployment of the experimental broadband ISDN network even more aggressively than European Commission officials. Also, European Commission officials have expressed an interest in funding an experimental broadband ISDN network linking only two or three major cities, Casteur said.

He added that carriers are leading the push to make the experimental network extend into virtually every major European country.

"They see this as a major commercial opportunity," he said.

Casteur said that carriers and European Commission officials expect broadband ISDN to be deployed according to common standards throughout Europe, thus complementing narrowband ISDN, which carriers have agreed to deploy according to common standards by 1993. He said that carriers are expected to implement versions of broadband ISDN based on European Telecommunications Standards Institute standards, which in turn will be based on CCITT standards.

"It's really with the advanced services, such as narrowband and broadband ISDN, that the integration of [public] network services in Europe will begin," Casteur said. ◪

Casteur added that carriers and European Commission officials expect broadband ISDN to be deployed according to common standards throughout Europe.

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AT&T to revamp Korean service

continued from page 17

feature to avoid the expense of running a separate billing system for the older service.

AT&T's Megacom with International Calling Capability offers users the same international calling rates as World Connect. But unlike World Connect, the Megacom capability allows users to combine international calling charges with domestic Megacom charges to receive usage discounts.

AT&T introduced its outbound-only World Connect international calling service in May 1988, promising users 5% to 8% discounts over its international direct-dialing service. Hundreds of users eventually subscribed to it.

AT&T introduced Megacom with International Calling Capability in August 1988 for service to Canada and Mexico, and expanded it in April 1989 to provide service to the rest of the world.

About 400 users currently subscribe to the Megacom international calling feature. ◪

PRODUCTS & SERVICES

THE LATEST OFFERINGS FROM VENDORS AND CARRIERS

First Look

Software lets LANs and mainframes communicate

Icot Corp. recently added two software packages to its OmniPath local-area network-to-mainframe line that enable nodes on a 4M bit/sec token-ring local-area network to communicate with an IBM mainframe.

One of the packages, **OmniPath Token Ring/PC,** allows a single node on the LAN to communicate with a mainframe using 3270 terminal emulation. It supports Distributed Function Terminal (DFT) mode, which enables a single workstation to support five host sessions at once.

The other package, **OmniPath Token Ring Gateway,** runs on a node designated as the gateway, as well as on every node requiring mainframe access through that gateway. The gateway, which provides host connectivity, communicates via Network Basic I/O System with the workstations, which perform 3270 emulation. The gateway portion can support between eight and 253 host sessions.

The OmniPath line previously consisted of gateways that supported Synchronous Data Link Control and DFT connections to mainframes at maximum speeds of 19.2K and 2.35M bit/sec, respectively.

With support for token-ring interfaces in IBM 3174 cluster controllers and 3745 front-end processors, the new products can support the full 4M bit/sec token-ring speed, the company said.

OmniPath Token Ring/PC and OmniPath Token Ring Gateway require only 40K bytes of random-access memory on each workstation because of a proprietary memory management feature, RAMiser, that allows programs to be swapped out of DOS memory when they are not in use. Competing products require between 150K and 240K bytes of RAM, the company said.

Both products are available now.

Token Ring/PC is priced at $495; Token Ring Gateway and workstation software ranges from $2,995 for eight users to $9,995 for 253 users.

Icot Corp., 3801 Zanker Road, P.O. Box 5143, San Jose, Calif. 95150; (408) 433-3300.

Kalpana introduces bridge using fast packet scheme

E-net bridge supports 3 concurrent connections.

By Tom Smith
New Products Editor

CAMPBELL, Calif. — Kalpana, Inc. recently unveiled an Ethernet bridge that uses fast packet switching technology to achieve higher throughput than other bridges.

The EPS-700 Multiport EtherSwitch can establish up to three simultaneous point-to-point connections among different Ethernets, as opposed to conventional bus-based Ethernet bridges that only establish a single-bridge connection.

EtherSwitch is a stand-alone bridge based on a switch matrix architecture that houses up to seven Ethernet interface boards, each of which supports an attached Ethernet.

The bridge employs circuit switching to transmit multiple packets over several switches working in parallel. By contrast, bus-based bridges only transmit a single packet at once to avoid collisions on the Ethernet.

In addition, EtherSwitch's fast packet switching technique improves throughput by reading only the first six bytes of an Ethernet address, which cuts down the filtering/forwarding delays inherent in conventional bridges, the company said. Other bridges read the entire packet — which typically ranges from 64 to 1,500 bytes — before forwarding it, which results in sizable propagation delays, sometimes as long as 800 microsec, according to Larry Blair, vice-president of marketing and sales at Kalpana.

Using fast packet technology, EtherSwitch averages delays of only 40 microsec, Blair said.

EtherSwitch is available now. A base configuration with two Ethernet interfaces costs $4,995, and a configuration with seven Ethernet interfaces is priced at $9,995.

Kalpana can be reached by writing to 550 Division St., Campbell, Calif. 95008, or by calling (408) 378-3645.

BT Tymnet unveils major upgrade to X.25 net sites

SAN JOSE, Calif. — BT Tymnet, Inc. last week said it is upgrading 200 local access sites on its Tymnet packet-switched net to support 2,400 bit/sec lines.

The upgrade, the first major expansion of BT Tymnet's dial-up services since the public packet-switched network was acquired by British Telecommunications PLC last November, will greatly reduce subscribers' local telephone connect time charges to load data onto the network.

It also makes 2,400 bit/sec local access available to users who would otherwise incur long-distance charges when dialing in to the nearest regional site supporting that transmission speed.

The company said the upgrade, a response to customer demand, will be completed by July 1. With the upgrade, 450 of the company's 533 Tymnet access locations will support 2,400 bit/sec, according to Mark de la Vega, product manager of access services for BT Tymnet.

Among the cities scheduled to get the higher local access speed are Dover, Del., Iowa City, Iowa, Bakersfield, Calif., Bloomington, Ind., Battle Creek, Mich., Fayetteville, N.C., Sioux Falls, N.D., Corning, N.Y., and Montpelier, Vt.

Sites currently being upgraded to 2,400 bit/sec will also continue to support 1,200 and 300 bit/sec speeds, de la Vega said. The move is part of a growing trend by the net provider's user base to demand high-speed access to the packet network.

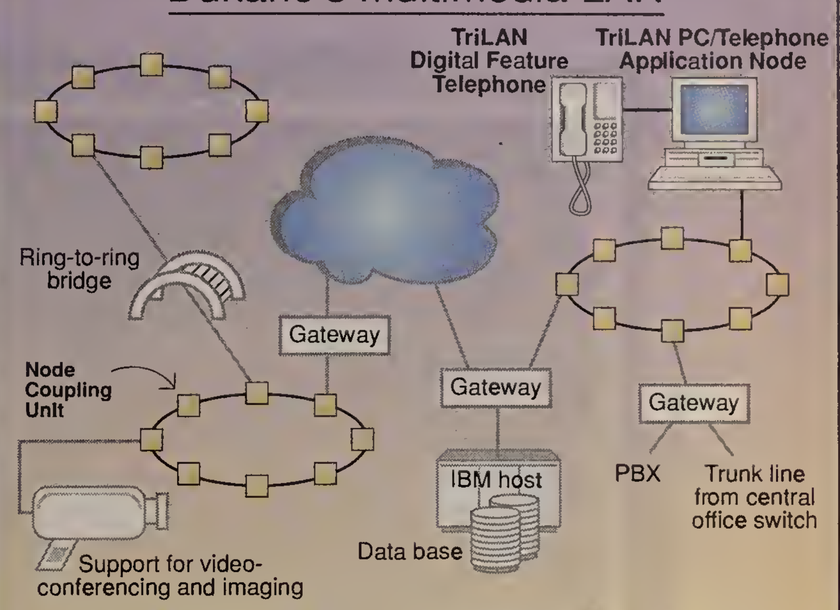
"Right now, we're looking at 2,400 bit/sec, but if you look at modem buying plans, 9.6K [bit/sec] is certainly going to see the highest growth. That's something we're moving toward," de la Vega said. BT Tymnet now offers 9.6K bit/sec access in just 18 cities, but will ramp up to 69 locations by June, he added.

The new 2,400 bit/sec local access points will also support Microcom, Inc.'s Microcom Network Protocol Levels 2, 3 and 4 for error correction, which assures users in areas notorious for noisy or faulty lines that data loaded onto the Tymnet node will have fewer errors, de la Vega said.

There is no change in BT Tymnet rates to access the network over 2,400 bit/sec lines, de la Vega said.

BT Tymnet can be reached by writing to 2560 N. First St., P.O. Box 49019, San Jose, Calif. 95161, or by calling (408) 922-0250.

Dukane's multimedia LAN


TriLAN Digital Feature Telephone
TriLAN PC/Telephone Application Node
Ring-to-ring bridge
Gateway
Node Coupling Unit
Gateway
Gateway
IBM host
PBX
Trunk line from central office switch
Data base
Support for video-conferencing and imaging

Up to 32 token-ring LANs, each supporting 64 devices, can be bridged to create a network supporting 2,048 devices.

SOURCE: DUKANE CORP.'S NETWORK INTEGRATION DIVISION, SAINT CHARLES, ILL.
GRAPHIC BY SUSAN J. CHAMPENY

LAN lets voice, data share cabling system

Dukane's TriLAN can support customer service, telemarketing applications at a reduced cost.

By Tom Smith
New Products Editor

SAINT CHARLES, Ill. — Dukane Corp.'s Network Integration Division recently introduced a 16M bit/sec token-ring local-area network that supports integrated voice and data traffic and will eventually support video.

TriLAN is being positioned to support customer service and telemarketing applications in which users receive a screen of related information, including data and images, when they answer an incoming call.

TriLAN is an integrated LAN that enables voice and data to share the same shielded twisted-pair cabling system, saving users the expense of installing separate wiring systems.

The primary component of TriLAN is the PC/Telephone Application Node, a token-ring interface board for IBM Personal Computer XTs and ATs that, in addition to supporting high-speed data transfers, has on-board firmware that supports a variety of call processing features. Those features include conferencing, speed dialing and call forwarding, as well as automatic number identification.

Calls can be dialed within the LAN, while calls originating from or destined for outside the network must pass through a gateway to private branch exchanges or to central office trunks.

The PC/Telephone Application Node allows Dukane's TriLAN Digital Feature Phone to plug into the backplane of the personal computer and share the network connection to transmit and receive voice packets.

While TriLAN initially will only support Dukane's own digital telephones, the company said it is hoping to strike agreements with other station equipment suppliers to support the technology.

By next year, the company said it plans to ship token-ring boards for IBM Personal System/2 microcomputers based on the Micro Channel Architecture.

The integrated telephone/workstation is attached to the token-ring network via a Network Coupling Unit (NCU), whose function is analogous to a media access unit.

The TriLAN network saves users the expense of installing separate wiring systems.

▲▲▲

A user can support eight NCUs on one token-ring LAN, which means up to 64 devices can reside on a given LAN. Ring-to-ring bridges, which Dukane expects to resell from token-ring bridge manufacturers, will enable as many as 32 TriLANs to be bridged together.

Thus, the network could support a total of 2,048 network addresses.

While TriLAN does not provide

(continued on page 42)

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The least a local area network can give you is time for lunch.

Some food for thought.

Getting all the information from all your equipment to all your people can occupy all your time.

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Bon appétit.

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OPINIONS

INTEROPERABILITY

BY CARL WARREN

RPC technology is a step in the right direction

Achieving interoperability appears to be a process of refining the steps. One important step in this process is remote procedure call (RPC) technology.

Although the definition of RPC technology is undergoing constant change, it is fundamentally a technique that allows users to invoke a procedure call on a remote system or node. Using RPC technology, a network user can evoke a procedure to be used by the calling node, such as locating items in a data base and creating a special report.

Since an RPC allows the user to run a procedure on another machine and use the results, the implication is that it defines a network version of parallel processing. But speed, which is an issue with parallel processing, will probably be inconsequential with RPC technology. It's more accurate to say that RPC techniques give the user more effective use of network resources and, therefore, better use of technology dollars.

> RPC techniques give the user more effective use of network resources.

▲▲▲

It's easiest to implement RPC technology on a homogeneous net. Sun Microsystems, Inc., for example, has developed an RPC called Open Network Computing (ONC) that seems to meet most needs as long as their brand of networking is not violated. However, Sun does claim that ONC can work on any kind of network.

Unfortunately, not many networks — not even those in the same organization — can claim 100% homogeneity; nor can they claim conformity to various standards. Most networks comprise various workstations, processing platforms and brands of network cards and software — with the result being that the idea of interoperability goes out the window.

The term "interoperability" implies that one or many components can operate together, which suggests that some commonality of structure exists at some level. RPC technology relies on the Open Systems Interconnection seven-layer model as its guide, and commonality comes at the session and application layers.

Besides involving a remote procedure, the RPC function has other complex duties with which to contend. The RPC has to be interoperable with the various protocols and command verbs used in called procedures. Additionally, address management of the local and remote servers and clients must be maintained, and data must be formatted in the proper target format.

Some interesting questions arise when considering RPC interoperability. Within a complex network, where does the global directory and dictionary reside? If each local-area network work group is responsible for its own, then there is a need for standard naming. What happens if the RPC comes from a DOS network and the call is to a Unix network? And in addition to these questions, we still have to consider error management, transmission frame sizes and rerouting.

System-to-system and system-to-network interoperability is no doubt on the horizon. The RPC is only one step in the journey, and the map to the destination is still being drawn. The emphasis on distributed processing or, more correctly, on wide-area information access, has heightened the need for interoperability.

Unfortunately, interoperability is still somewhere in the technological future.

Warren is a senior engineer in the space station division of McDonnell Douglas Space Systems Co. in Huntington Beach, Calif.

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The Newsweekly of User Networking Strategies

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(508) 875-6400
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EDITORIAL

European regulatory reform stands to benefit U.S. users

The notion has become almost a cliche, but it stands repeating: The decade ahead will bear little resemblance to the one we just left behind.

Already, historians have witnessed enough epoch-changing events to fill a textbook. East Germans have voted in a political party aligned with West Germany, multiparty elections are scheduled for the Soviet Union, and a grandmother has peacefully toppled a Nicaraguan regime that the Reagan administration fought for years to bring down.

These changes are mirrored in the communications industry, where a sort of global glasnost has set in. Carrier monopolies are collapsing. Free competition is springing up. And nowhere are the changes so dramatic as in Western Europe, where the European Commission is pushing reforms designed to pry open the continent's monopoly network markets.

These changes are especially important for U.S. users because an increasing number of them are rushing to compete in the emerging Common Market. When they arrive, these expatriates seek to deploy the same kind of advanced networks they rely on at home.

What they quickly learn, however, is that setting up private networks in Europe means grappling with the communications industry's version of the Berlin Wall — monopoly carriers and restrictive regulation.

Because of tepid competition to provide dedicated international circuits on the continent, Europe's carriers are able to charge users between four and 20 times the cost of providing service, according to some estimates. Technical requirements vary so much from country to country that standardizing on equipment is all but impossible.

In theory, such restrictions hurt European and U.S. users equally. In practice, however, it doesn't work that way. U.S. businesses have grown accustomed to using private networks to gain a strategic edge, while Europeans have not become nearly so reliant on them. Companies that use private nets have learned to cope with the tremendous cost and regulatory barriers.

> Setting up private networks in Europe means grappling with the communications industry's version of the Berlin Wall.

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Thus, when American firms do business in Europe, they are often forced to abandon critical network applications. Network-based just-in-time inventory systems are pushed aside, and vital communications links to customers drop by the wayside. U.S. firms are forced to fundamentally change the way they do business, while it's business as usual for Europeans.

Yet the disadvantages U.S. firms face today may evaporate in the decade ahead. Regulatory reform is sweeping the continent as Europeans struggle to create the same kind of integrated, competitive network environment we have here.

U.S. users can take advantage of that. By drawing on their experience with divestiture and aggressively seeking new opportunities, U.S. users can be among the first to deploy innovative, money-saving network applications.

They can guide investment decisions using their background with such technologies as very small aperture terminal satellite networks, which have been available here for years but are only now being allowed in European countries.

Above all, U.S. users should stay informed of developments on the European front and pressure carriers to accelerate the move toward open competition in Europe. This will help create a network environment favorable to all users, but particularly to those from the U.S., who will be able to export a domestic networking advantage overseas.

OPINIONS

NETWORK PLANNING

BY JAMES HERMAN

Central control: A strategy whose time has gone

Revolution is shaking the information systems (IS) department. Users are embracing a new vision of computing that puts more power at their fingertips and frees them from waiting in long lines for centrally developed applications. Like Eastern European Communist leaders, MIS directors and net managers are scrambling to redefine their roles and the role of the enterprise network.

Just as the idea of centrally planned and controlled economies has gone totally bankrupt over the past year, so has the idea of total central planning and control of information technology. No one person or group is smart enough to figure out all the ways to use these rapidly changing technologies. The top-down approach has given way to a bottom-up approach.

Users and departments have won new freedom by purchasing low-cost personal computers, workstations and servers. They are networking them, often without central direction, using personal computer local-area networks.

End-user computing now accounts for the majority of software development in most organizations. Easy-to-use tools allow today's information workers to solve their problems now, rather than wait for data center help. Users in every department are cracking the data center monopoly on IS technology and buying systems that meet their particular needs.

The central committee no longer dictates what you put on your desk or how it will communicate. The one-protocol system is dead; a new pluralistic network is taking its place.

This new democratic movement started on LANs connected by transparent bridges, where Transmission Control Protocol/Internet Protocol, Xerox Corp.'s Xerox Network Systems, Digital Equipment Corp.'s DECnet, IBM's Systems Network Architecture and the International Standards Organization's Open Systems Interconnection model peacefully coexist. Now multiprotocol routers have extended this free-market approach to the enterprise backbone.

Diversity and decentralization of networks and computing are two key constraints that network and data processing managers must recognize. Most organizations today have one of every type of LAN, workstation, server and protocol. New applications appear on the network without forecasting. Traffic patterns are unpredictable, and traffic volume rises quickly.

The one-protocol system is dead; a new pluralistic network is taking its place.

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These changes are irreversible; there's no turning back to a simpler time when a single vendor met all your needs. Clamping down on the spread of this new user-driven technology with repressive controls on purchasing and connectivity will only generate resentment and encourage evasion of the new restrictions. Diversity and change are necessary characteristics of the enterprise information architectures of the 1990s.

Although there will be freedom at the desktop, there must be some discipline in the backbone. It is through the backbone that all elements of the enterprise are able to share information. Our capitalist economies depend on a tightly controlled monetary system that permits the free exchange of goods and services. Similarly, we need rules on interoperability standards in our network backbones that allow information to move effectively among different parts of the enterprise.

Users must understand that with freedom comes responsibility. Plugging random boxes into an enterprise network and disrupting the service of thousands of users cannot be tolerated. Rules for the testing and registration of new devices coming onto enterprise networks are a reasonable and necessary part of an essentially decentralized networking strategy.

All of these changes necessitate a new point of view on network management. Net managers must become more strategic in their thinking and proactive in their actions. They must get out in front of the demand curve for network service by building in anticipation of future needs.

Network managers can no longer sit back and wait for carefully defined requirements. They must think more than one move ahead — the very definition of strategy — and engage in a dialogue with users to understand where they are going with new applications and technologies.

Those managers who retreat to the relative safety of the data center to concentrate on the backlog of centrally developed applications may quickly find events passing them by, as more departments take matters into their own hands.

We live in interesting times. Successful managers will be those who accept the challenge of forging a new vision of the enterprise utility that supports distributed, decentralized processing. Centrally developed applications should be designed to enhance distributed solutions.

The leaders of the next revolution in computing will be those who actively work to create the distributed computing base and tap into its enormous potential for innovation and creativity in the use of user-oriented information technology.

Herman is a principal with Northeast Consulting Resources, Inc., a Boston-based consulting collaborative focusing on information technology and strategic management.

TELETOONS

BY FRANK AND TROISE

It's called a CLAN..
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LETTERS

Last word on hybrid nets

Your feature article "Public net compatibility key for T-1, T-3 muxes" (*NW,* March 5) clearly identified standards compatibility as an important factor in the choice of a T-3 multiplexer. Most of the significant issues involved in public network interoperability were identified and explained in a clear, concise manner.

The initial vendor-specific topic that is mentioned in this particular article is that of fast packet switching vs. circuit switching. It is important for users to understand that fast packet switching is proprietary. Fast packet is not a standard, it is not fully compatible with the carrier networks, and it does not allow users to take advantage of public network services such as disaster recovery and subrate circuit rerouting.

Users should also note that frame relay, a new packet-mode bearer service defined under Integrated Services Digital Network, is expected to become a standard within the next few months.

A broad description of frame-relay architecture and service requirements is contained in CCITT recommendation I.122. Frame relay will provide users with the benefits of fast packet while still maintaining standards compatibility.

As a highly respected industry publication, *Network World* has consistently interpreted complex technical subjects in a well-rounded, unbiased manner.

Although this article accurately summarizes the key ingredient for hybrid networking, users should be aware that products supporting fast packet technology will not be compatible with the public switched network.

David Helfrich
Director of product marketing
Newbridge Networks, Inc.
Herndon, Va.

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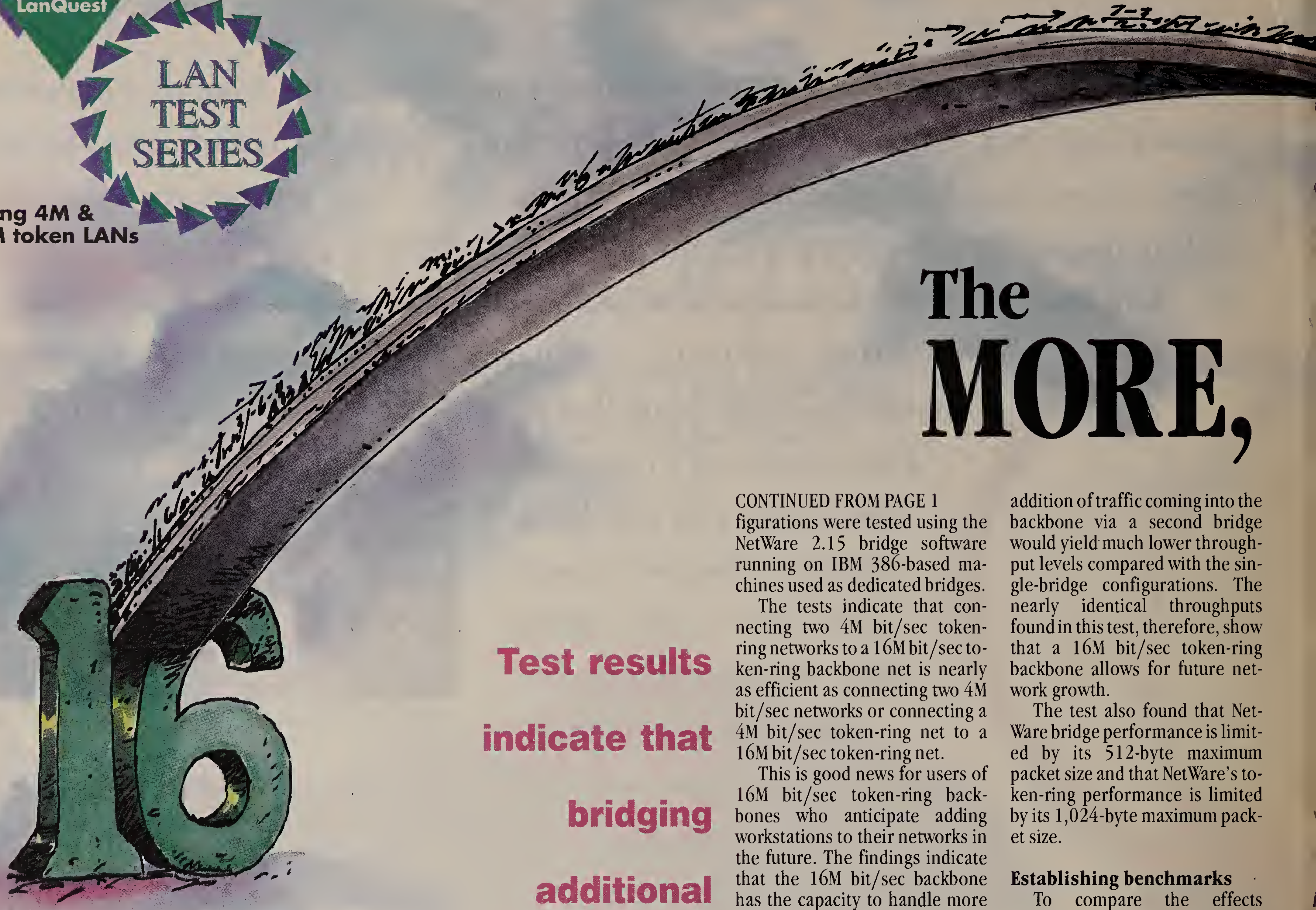


ILLUSTRATION ©1990 KEVIN POPE

Test results indicate that bridging additional LANs to a backbone has no adverse effects on throughput.

CONTINUED FROM PAGE 1

figurations were tested using the NetWare 2.15 bridge software running on IBM 386-based machines used as dedicated bridges.

The tests indicate that connecting two 4M bit/sec token-ring networks to a 16M bit/sec token-ring backbone net is nearly as efficient as connecting two 4M bit/sec networks or connecting a 4M bit/sec token-ring net to a 16M bit/sec token-ring net.

This is good news for users of 16M bit/sec token-ring backbones who anticipate adding workstations to their networks in the future. The findings indicate that the 16M bit/sec backbone has the capacity to handle more workstations, more local-area networks bridged to the backbone or both.

If the backbone were being stressed to its fullest capacity, the addition of traffic coming into the backbone via a second bridge would yield much lower throughput levels compared with the single-bridge configurations. The nearly identical throughputs found in this test, therefore, show that a 16M bit/sec token-ring backbone allows for future network growth.

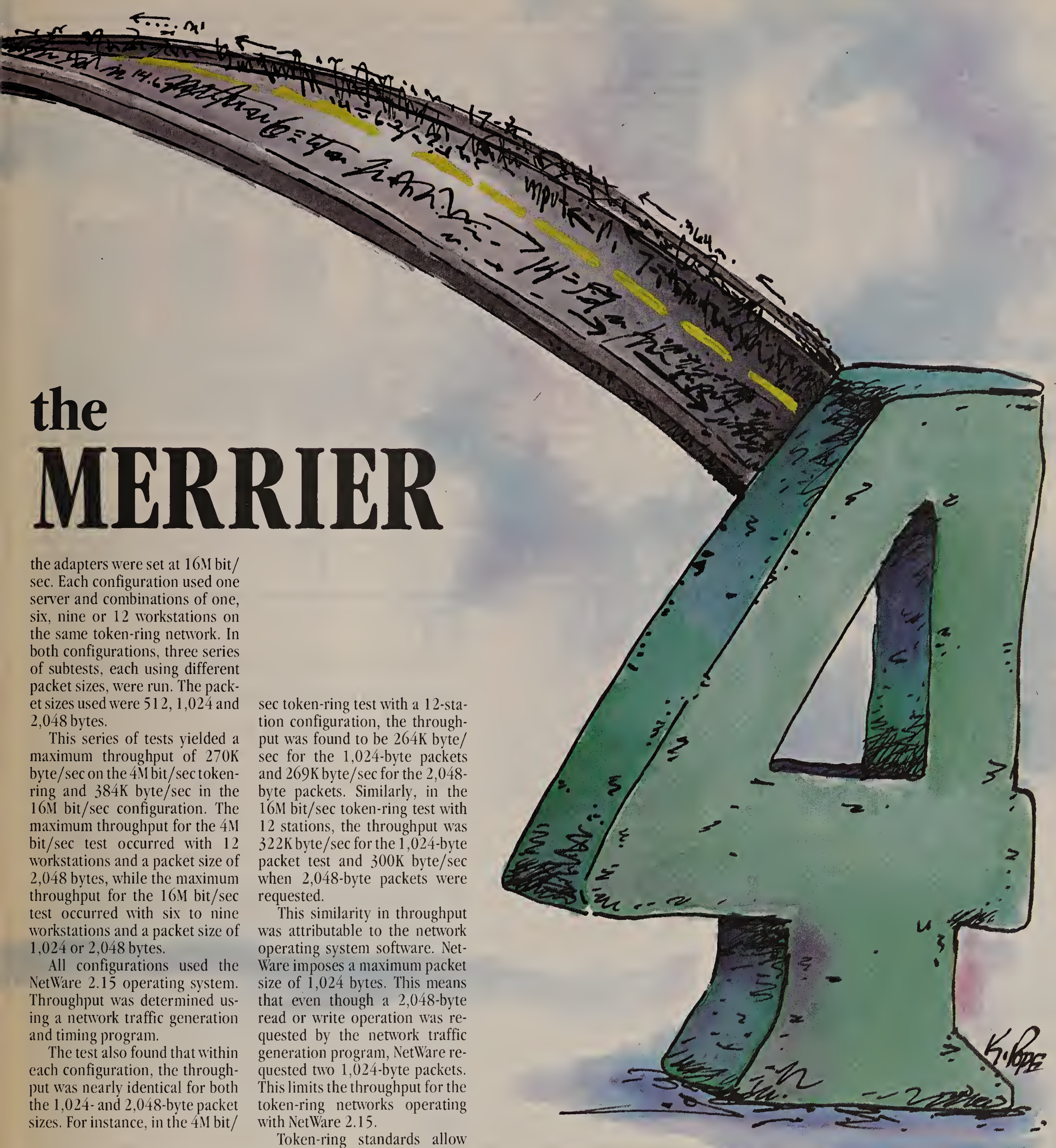
The test also found that NetWare bridge performance is limited by its 512-byte maximum packet size and that NetWare's token-ring performance is limited by its 1,024-byte maximum packet size.

Establishing benchmarks

To compare the effects of bridging, two end-to-end throughput tests were first conducted on isolated token-ring networks. The results from these tests were then used as benchmarks to compare with the results from tests of bridged token-ring networks.

The single-ring tests ran in two configurations. In the first configuration, the IBM Token-Ring adapters were set at 4M bit/sec. In the second configuration,

the
MERRIER



the adapters were set at 16M bit/sec. Each configuration used one server and combinations of one, six, nine or 12 workstations on the same token-ring network. In both configurations, three series of subtests, each using different packet sizes, were run. The packet sizes used were 512, 1,024 and 2,048 bytes.

This series of tests yielded a maximum throughput of 270K byte/sec on the 4M bit/sec token-ring and 384K byte/sec in the 16M bit/sec configuration. The maximum throughput for the 4M bit/sec test occurred with 12 workstations and a packet size of 2,048 bytes, while the maximum throughput for the 16M bit/sec test occurred with six to nine workstations and a packet size of 1,024 or 2,048 bytes.

All configurations used the NetWare 2.15 operating system. Throughput was determined using a network traffic generation and timing program.

The test also found that within each configuration, the throughput was nearly identical for both the 1,024- and 2,048-byte packet sizes. For instance, in the 4M bit/sec token-ring test with a 12-station configuration, the throughput was found to be 264K byte/sec for the 1,024-byte packets and 269K byte/sec for the 2,048-byte packets. Similarly, in the 16M bit/sec token-ring test with 12 stations, the throughput was 322K byte/sec for the 1,024-byte packet test and 300K byte/sec when 2,048-byte packets were requested.

This similarity in throughput was attributable to the network operating system software. NetWare imposes a maximum packet size of 1,024 bytes. This means that even though a 2,048-byte read or write operation was requested by the network traffic generation program, NetWare requested two 1,024-byte packets. This limits the throughput for the token-ring networks operating with NetWare 2.15.

Token-ring standards allow for larger packet sizes. For example, the IEEE 802.5 token-ring standard allows a maximum packet size of 4K bytes on 4M bit/sec token-ring networks and 18K bytes for 16M bit/sec token rings. Reportedly, future releases of Novell's operating system will offer larger packet sizes.

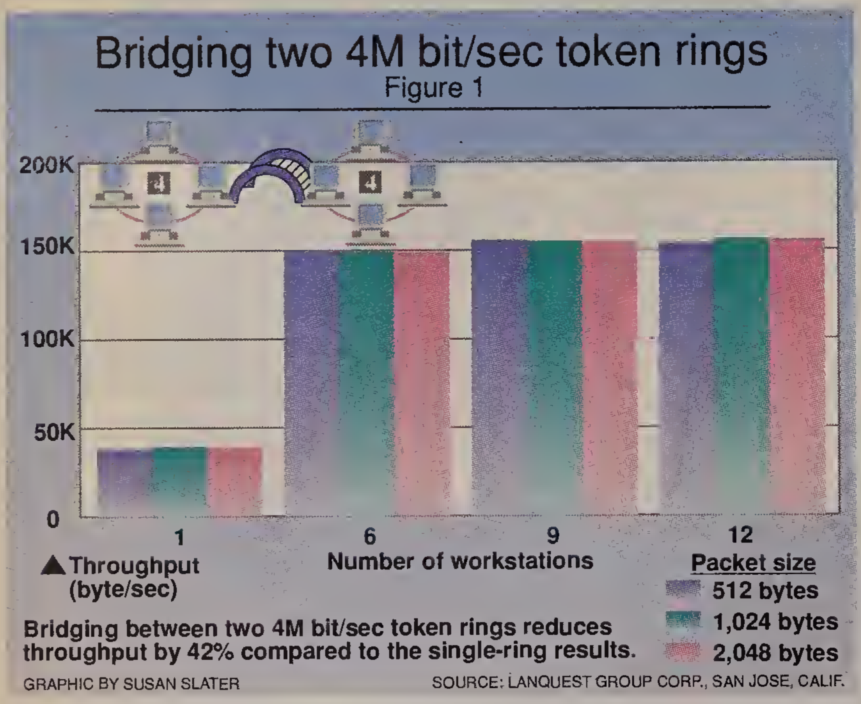
The operating system's restriction of packet size is not the only thing limiting network throughput. The previous *Network World* LAN Test ("16M vs. 4M token-ring: Fourfold improvement?" *NW,* Feb. 12) pointed out that there are many components involved in the movement of data from a personal computer, through the adapter, onto the network, and onto the server and back.

Two major components are the network operating system and the network adapter card driver. Our previous test showed that to achieve the maximum potential throughput over either the 4M or 16M bit/sec token ring, both the NetWare software and NetWare token-ring drivers must accommodate larger packet sizes. Novell is working on improved token-ring drivers that are expected to be available by the third quarter of this year.

(continued on page 28)

Bridging two 4M bit/sec token rings

Figure 1



Bridging between two 4M bit/sec token rings reduces throughput by 42% compared to the single-ring results.

GRAPHIC BY SUSAN SLATER   SOURCE: LANQUEST GROUP CORP., SAN JOSE, CALIF.

(continued from page 27)

After establishing benchmark performance levels for the single-ring networks, the next step was to use a two-ring configuration with one bridge connecting the rings.

Two sets of tests were performed using one bridge and two rings. One test used two 4M bit/sec token rings; the other used a 4M bit/sec ring attached to a 16M bit/sec backbone. In each test, the server and workstations were on different rings.

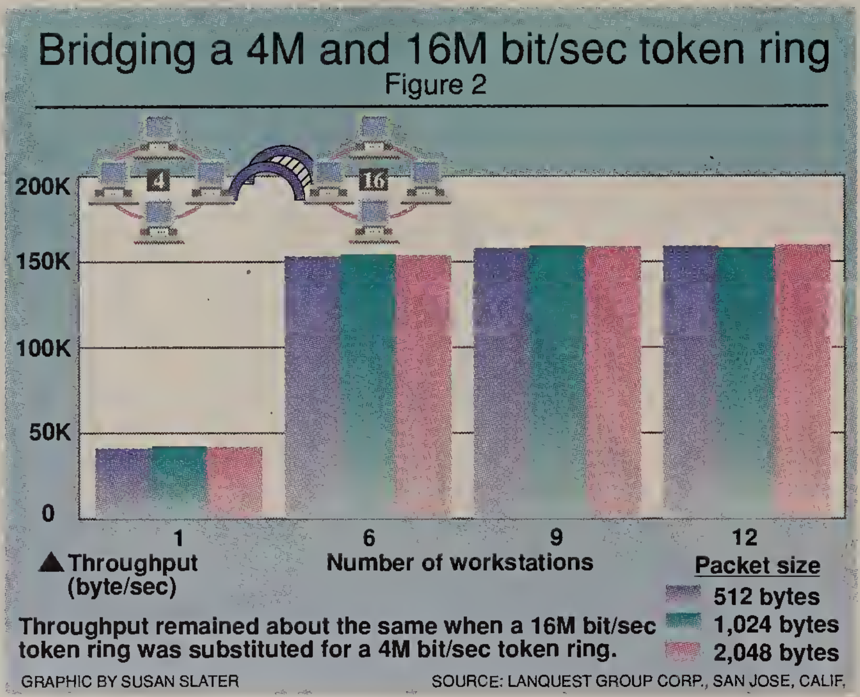
Maximum throughput for the 4M-to-4M network configuration was found to be 156K byte/sec (see Figure 1, this page). This represents a 42% loss in throughput when compared with the single 4M bit/sec ring setup used in the benchmark tests, which produced a maximum throughput of 270K byte/sec.

Similar results were found for the 4M bit/sec token-ring net connected with the 16M bit/sec backbone. In this configuration, maximum throughput was found to be 160K byte/sec (see Figure 2, this page). In this case, maximum throughput was reduced by 41%, due to the bridge between the 16M bit/sec net and the server on the 4M bit/sec net.

Is such a loss significant? No.

Bridging a 4M and 16M bit/sec token ring

Figure 2



Throughput remained about the same when a 16M bit/sec token ring was substituted for a 4M bit/sec token ring.

GRAPHIC BY SUSAN SLATER   SOURCE: LANQUEST GROUP CORP., SAN JOSE, CALIF.

The purpose of using a bridge is not to boost the overall network throughput, but to improve performance on a section of the net by allowing it to be divided into two or more segments.

For example, a common use of a bridge is to link two distinct groups using a network backbone — for example, an accounting department and sales order-entry department. In this case, most of the activity on the accounting department network does not concern the sales department and vice versa. If both departments are on the same network, all stations compete for the same tokens. Dividing the two departments into two networks and linking them with a bridge will contain traffic for each department on that department's ring.

One fact that emerged from the tests is that in a two-ring and one-bridge configuration, the throughput is similar for all three record sizes.

For example, in the 4M bit/sec token-ring-to-4M bit/sec token-ring configuration with 12 workstations, the throughputs were found to be 154K, 156K and 156K byte/sec for record sizes of 512, 1,024 and 2,048 bytes, respectively. Similarly, in the 4M bit/sec token-ring-to-16M bit/sec token-ring configuration with 12 workstations, the throughputs were 159K, 158K and 160K byte/sec for packet sizes of 512, 1,024 and 2,048 bytes, respectively.

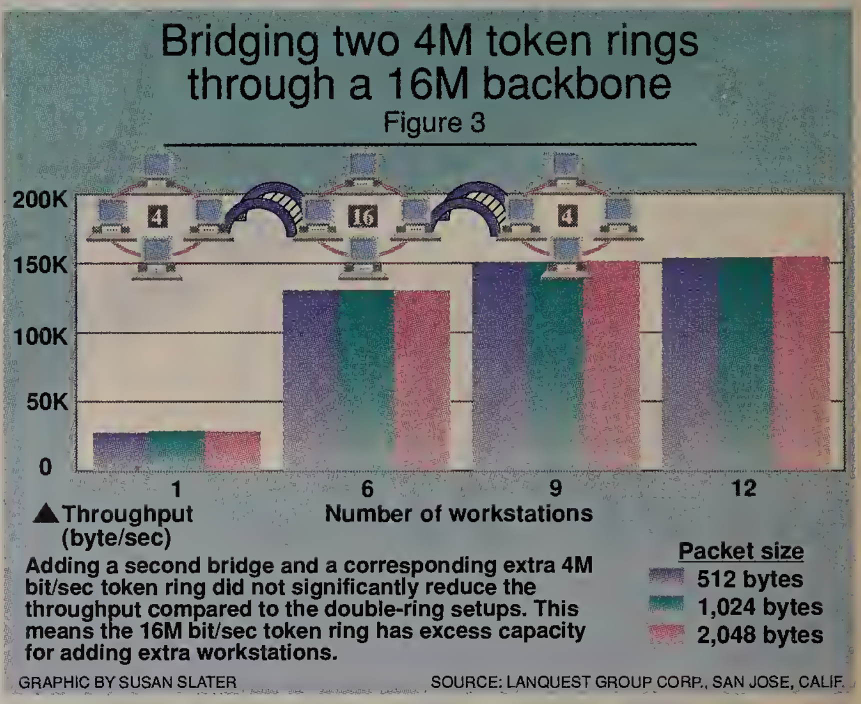
The similarity of results is attributable to the NetWare bridge software, not the operating system, as was the limiting factor in the single-ring benchmark tests. The bridging software forces the packet size to a maximum of 512 bytes, so it doesn't matter what record sizes are requested.

This 512-byte size was chosen because it provides a least common denominator in packet size so that all types of networks may be bridged to a token-ring backbone. For example, the software allows the bridge to be connected with an Arcnet network, which has a smaller maximum packet size of 512 bytes.

One way around this 512-byte limit might be to use source routing software in the bridge. This would make it possible to preset the route a packet will travel in a network that contains disparate LAN architectures. Once the different architectures are programmed into the bridge — for example, 4M bit/sec token-ring, Ethernet and Arcnet — a maximum packet size can be determined for any route.

Bridging two 4M token rings through a 16M backbone

Figure 3



Adding a second bridge and a corresponding extra 4M bit/sec token ring did not significantly reduce the throughput compared to the double-ring setups. This means the 16M bit/sec token ring has excess capacity for adding extra workstations.

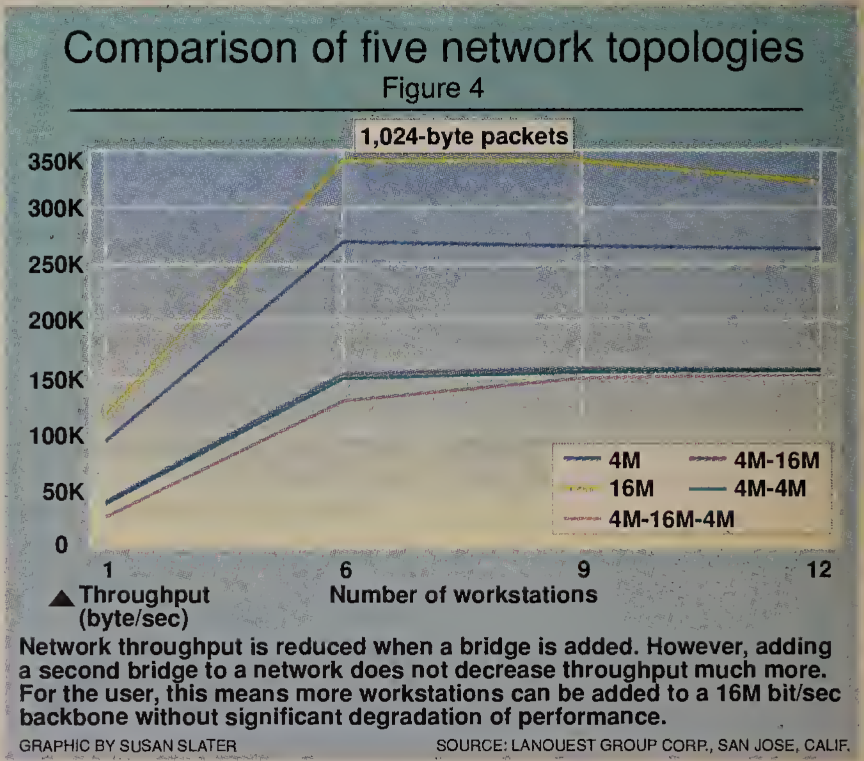
GRAPHIC BY SUSAN SLATER   SOURCE: LANQUEST GROUP CORP., SAN JOSE, CALIF.

One way around a 512-byte limit might be to use source routing software in the bridge.

▲▲▲

Comparison of five network topologies

Figure 4



Network throughput is reduced when a bridge is added. However, adding a second bridge to a network does not decrease throughput much more. For the user, this means more workstations can be added to a 16M bit/sec backbone without significant degradation of performance.

GRAPHIC BY SUSAN SLATER   SOURCE: LANOUEST GROUP CORP., SAN JOSE, CALIF.

The final configuration that was tested used two 4M bit/sec token-ring networks connected to a 16M bit/sec backbone network by bridges (see Figure 3, this page). Several versions of the test were run using combinations of one, six, nine and 12 workstations on one 4M bit/sec token ring and the server on the other 4M bit/sec token-ring network. These versions were run with the 16M bit/sec net as the backbone to which both LANs were connected by bridges. Within each version of this test, the workstations requested sequential reads and overlay writes of a 1M-byte file on the server in three packet sizes — 512, 1,024 and 2,048 bytes.

Under heavy traffic, the throughput of the three-ring, two-bridge setup matched that of the two-ring, one-bridge configurations.

Throughput for the three-ring configuration with 12 workstations was 154K, 154K and 155K byte/sec for packet sizes of 512, 1,024 and 2,048 bytes, respectively. In the double-ring tests, the results were about the same — from 154K to 160K byte/sec for the range of packet sizes.

From these results, the conclusion may be drawn that adding a second network by way of a bridge produces virtually no additional stress on the 16M bit/sec backbone. In other words, after installing one LAN via a bridge on a 16M bit/sec backbone, bridging an additional LAN to the backbone causes little or no degradation of throughput (see Figure 4, this page).

This bodes well for users installing a 16M bit/sec token ring as a backbone; they will have the capacity to expand without degrading network throughput. ◼

Testing methodology

The objective of the adapter subsystem test was to measure the maximum effective throughput of the token-ring adapter card in the local-area network server.

The test consisted of two operations: a sequential read and an overlay write. Network traffic between the stations and the file server was generated with a program that performed either overlay writes or sequential reads of a 1M-byte file using 512-, 1024- and 2048-byte record sizes.

All of the stations on the network were synchronized to start at the same time, and each station shared a common file with the other stations. The stations performed either the read or the write on shared data base files in the file server. Measurements were made using a Network General Corp. Sniffer protocol analyzer.

The network traffic generation program isolated the disk subsystem. This was accomplished by using the file server's disk-caching capabilities. Reading and writing to the file server's cache, rather than the server's hard disk, was ensured by using shared files and keeping record sizes below 4,096 bytes.

A Compaq Computer Corp. DeskPro 386/33 with 8M bytes of memory was used as the server in the tests. The workstations were 8-MHz IBM Personal Computer AT-compatible, 286-based computers built by Samsung Electronics America, Inc. These machines each had 1M byte of memory. The network testing configurations used a single server and combinations of one, six, nine or 12 workstations.

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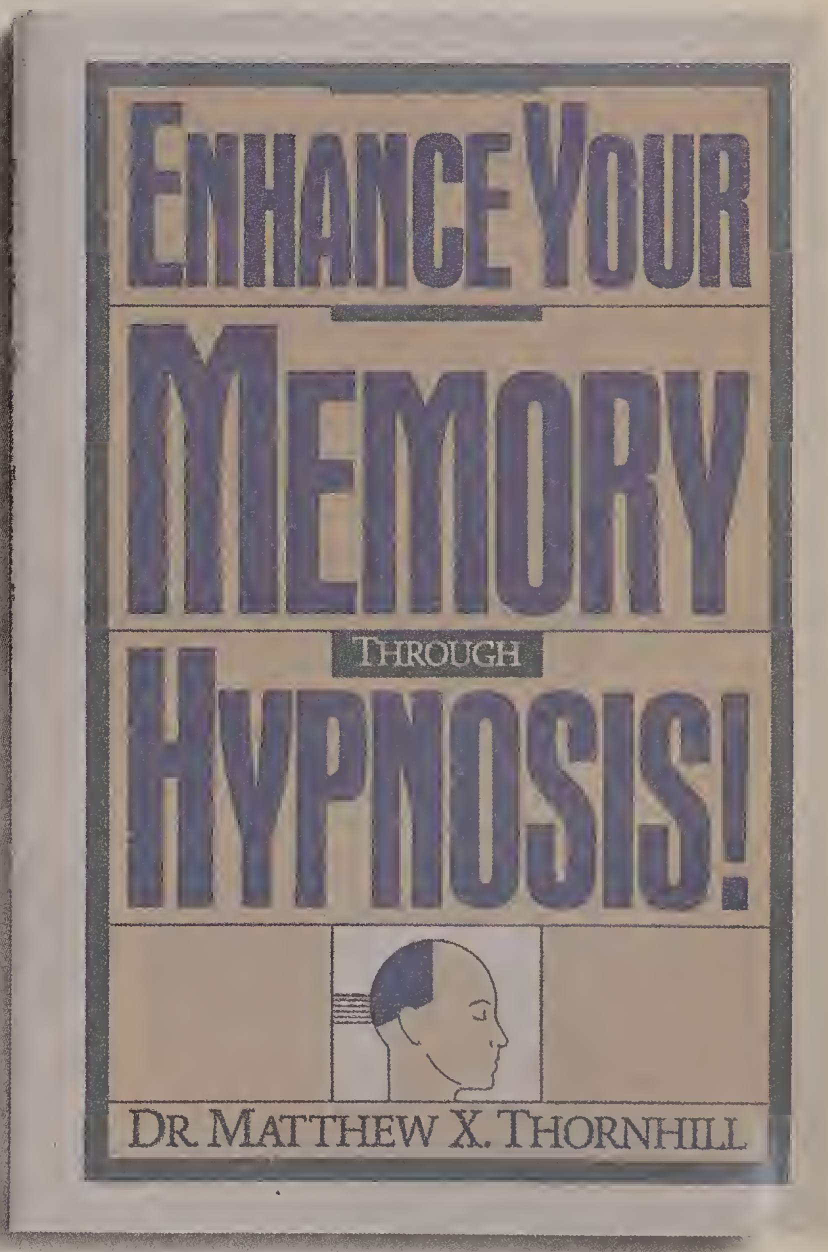

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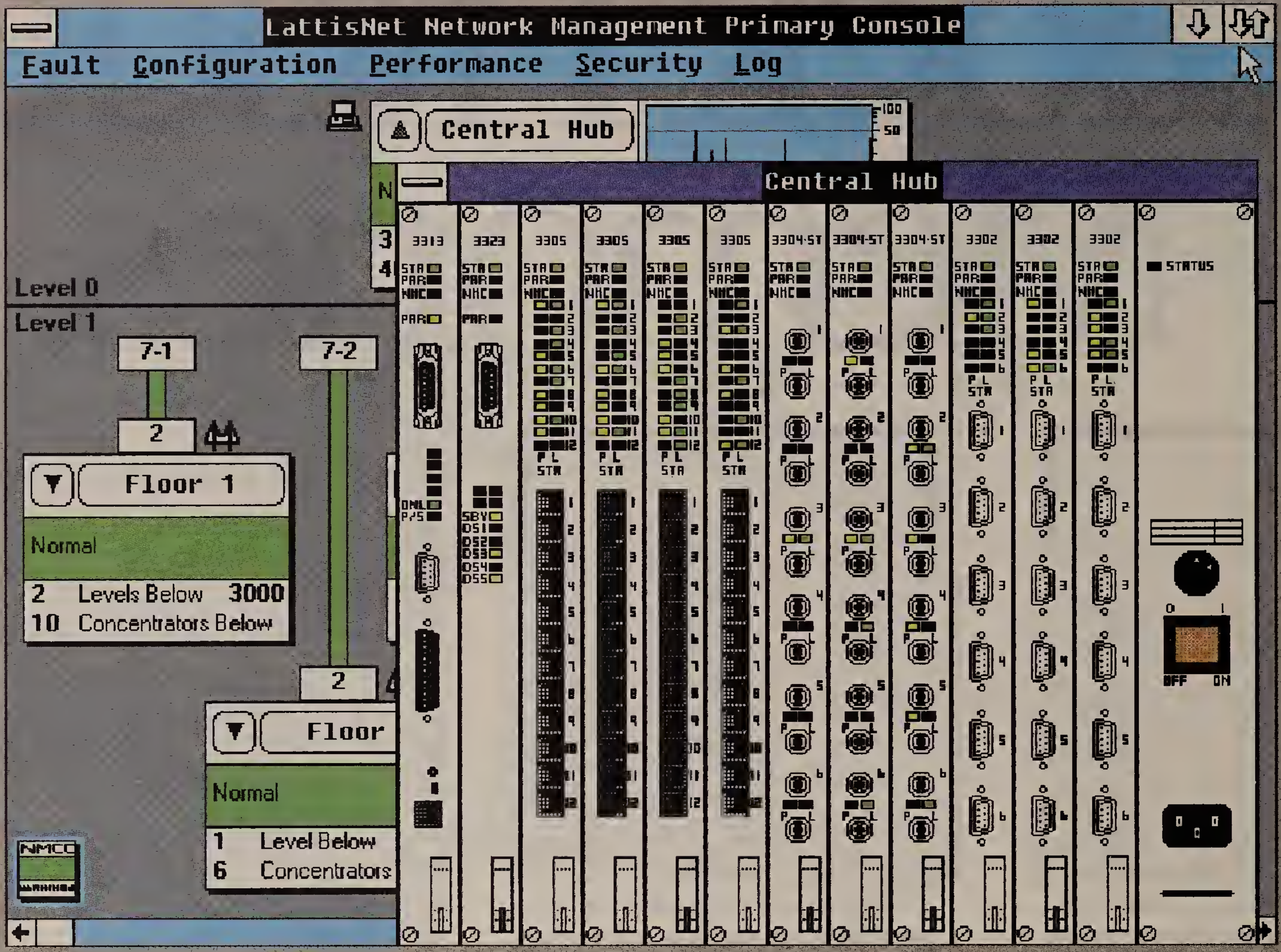

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A LAN on wheels

The 'smart car' of the future will contain an internal local-area network.

Local-area networks are showing up in some unusual places these days. Over the next several years, most U.S. and foreign automobile manufacturers will be equipping their vehicles with internal LANs — also called vehicle multiplexing networks — linking the on-board computers that control "smart" functions such as active suspension and antiskid braking.

The car of the 21st century will be a LAN on wheels, many industry observers predict. High-speed internal data networks will place more power and control in the hands of drivers, thanks to improved real-time coordination between the engine, transmission, suspension, brakes and other critical systems.

Smart tires are currently under joint development by The Goodyear Tire & Rubber Co. and Lotus Engineering of England. These tires will send data to the car's computer processor, which will instruct the tires to inflate or deflate depending on road conditions. It will be like riding on a cushion of data (see "Smart car functions," page 40).

(continued on page 32)

Kobielus, a contributing editor to Network World, *is an information technology consultant in Alexandria, Va.*

BY JAMES KOBIELUS

ILLUSTRATION ©1990 TOM BARRETT

(continued from page 31)

In addition, vehicle multiplexing will dramatically reduce the amount of wiring in the average automobile, making it easier and cheaper for automakers to add new electronic components.

Streamlined wiring translates into lower vehicle weight and enhanced reliability, according to Jerome Rivard, a Birmingham, Mich., consultant and former chief engineer at Ford Motor Co. The number of wires in the average car door could drop from 50 to four, with that many fewer connectors to worry about.

Slow move to multiplexing

All these benefits notwithstanding, it will be several years before fully integrated vehicle multiplexing systems are available in production models, Rivard says. The technology is new, industry standards have yet to emerge, and automakers are still experimenting with more limited forms of multiplexing.

So far, most vehicle multiplexing applications have been limited, appearing principally in luxury models such as General Motors Corp.'s Cadillac Allante sports car. In the Allante, a single point-to-point multiplexing link takes the place of separate physical wires between driver controls and exterior lights. The GM Allante, like most multiplexing implementations to date, is based on data-bus interface chips and protocols specific to the automaker.

Economics is one of the key factors slowing the move to full multiplexing, according to William Ribbens, director of the University of Michigan's Vehicular Electronics Laboratory and an associate professor in electrical engineering and computer science. "Full shared-bus multiplexing is currently more expensive than traditional point-to-point automotive wiring schemes," he says, "owing principally to the cost of the electronic components."

Another delaying factor is the lack of industry protocol standards for interfacing microcontrollers to the on-board data communications bus. Many automakers are using proprietary bus-interface chip designs in their vehicles, which prevents the industry as a whole from achieving economies of scale in the deployment of on-board data networks.

Frederick Miesterfeld, supervisor of Chrysler Corp.'s Advanced Development Laboratory, heads a committee of the Society of Automotive Engineers (SAE) that is working on a proposed bus-interface standard, known as J1850, for medium-speed vehicle multiplexing networks. "U.S. experts think the J1850 protocol is the right way to go," Miesterfeld says. Ultimately, though, "the marketplace sets the standards based on whatever does the job at the right cost."

SAE's members, drawn from auto manufacturers, suppliers and chip makers worldwide, are currently voting on J1850, which many observers consider the odds-on favorite for the industry standard supporting low- and medium-speed smart car applications.

J1850 specifies an asynchronous serial data communications interface that can operate at data-bus speeds of 10.4K bit/sec, 41.6K bit/sec or 125K bit/sec, depending on the requirements of the application. Media access control is through carrier-sense multiple access with nondestructive arbitration, which enables the highest priority message to seize control of the bus and continue transmitting after collisions without losing a millisecond or a speck of data.

The likely candidate for a high-speed multiplexing standard is the Controller Area Network (CAN) protocol developed by Intel Corp. and Robert Bosch GmbH, an automotive components manufacturer based in Stuttgart, West Germany. CAN, implemented on Intel's 82526 integrated circuit, supports data rates of up to 1M bit/sec. These rates are dictated by the millisecond data update requirements of such applications as braking and engine control.

CAN will also support the lower speed applications covered by J1850, though at a considerably higher price. Miesterfeld estimates that CAN chips would cost about $3 a piece in large production runs, while the J1850 chip would cost about $1.50 each in quantity.

Different niches

One likely scenario is that J1850 and CAN will each serve separate niches in the vehicle multiplexing market, according to Sanjay Gupta, manager of Intel's Automotive In-Vehicle Network product line.

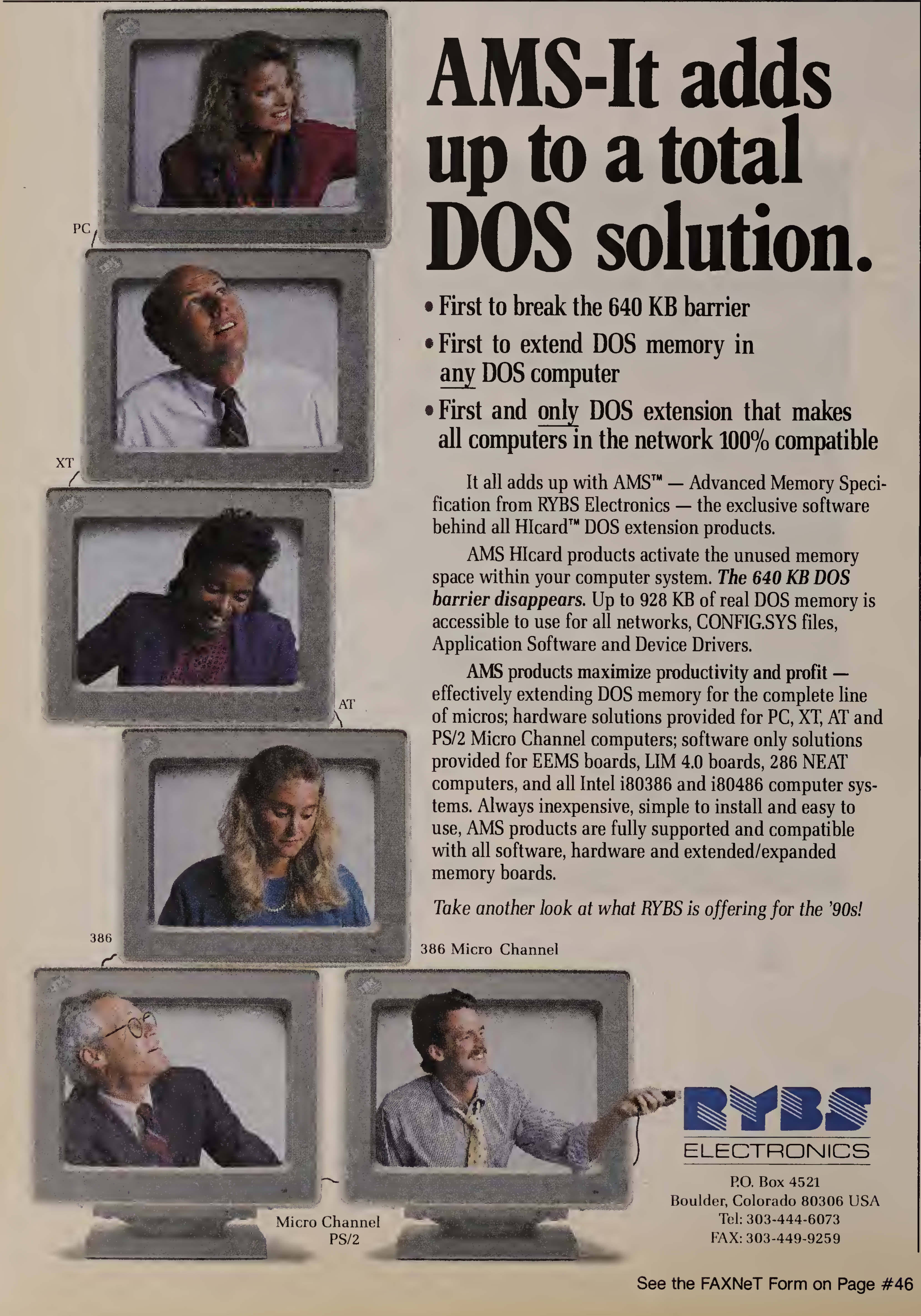
"High-speed multiplexing applications, such as those supported by CAN, will be implemented first in trucks and buses in the U.S.," Gupta predicts. "Passenger car multiplexing can be served currently by a medium- to low-speed interface such as J1850."

Gupta says he also foresees CAN catching on first with European automakers. "The International Standards Organization [ISO], which exercises more influence in Europe than in the U.S., is using CAN as the basis for its high-speed serial communications standard," he says. "We can expect to see CAN incorporated into passenger cars starting in the 1991 model year."

There is ongoing coordination between standards committees at SAE and ISO, primarily through people who work with both organizations, Gupta says. He points out that several SAE committees, including a truck/bus multiplexing committee on which he serves, are strongly considering the CAN standard for high-speed applications.

These standards are not cookbooks that describe in detail how to engineer a vehicle multiplexing network, Gupta says. Instead, they provide the automakers with considerable flexibility to tailor multiplex-

(continued on page 34)



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(continued from page 32)

ing networks to various applications.

For example, the SAE's J1850 draft standard specifies alternate implementations for media (single-wire copper, unshielded twisted-pair copper), electrical interface (voltage-driven, current-driven), bit encoding (pulse-width modulation, variable pulse-width modulation), bit rates (10.4K, 41.6K or 125K bit/sec) and error detection (cyclic redundancy check, no cyclic redundancy check).

According to Rivard, there can be no single hard-and-fast specifications for these and other vehicular network design elements. The reason for this is because each network designer works with a completely different set of requirements and constraints, which include performance, cost, available technology and regulations.

Engineering requirements

Indeed, automotive network designers as a group must observe space, noise, heat and performance requirements, which are almost unheard of with the run-of-the-mill office LAN. The vehicular network is confined to a narrow space, jarred continually by shaking and vibration, subjected to considerable heat and electromagnetic radiation from the engine and other vehicle systems, and required to pass error-free data at millisecond speeds.

If for no other reason, fully multiplexed vehicular networks will become a necessity in most automobiles simply as a means of cramming more electronic components into a fixed space, according to the University of Michigan's Ribbens. He says he foresees the cost of vehicular electronics rising from its current rate of between 8% and 10% of total car production costs to around 20% by the year 2000.

"Automotive engineers used to just bolt in a new electronic system without thinking through how it would impact on or integrate with existing electronics," Ribbens observes. "But the industry is taking more of a systems engineering approach to vehicular electronics these days. New functions are considered in the context of an overall vehicle's electronic architecture."

In spite of differences among particular automakers' implementations, one can begin to outline the general vehicle multiplexing network architecture being developed throughout the industry. The same general concepts — topology, medium, bandwidth and protocol — apply equally to both office and automotive LANs.

Topology

The auto industry is moving away from a point-to-point wiring topology and toward a shared bus architecture. In fact, cars of the future will likely have two parallel buses: one wire to pass data and the other to distribute electrical power to all vehicle components.

The data bus will be the car's central nervous system. It will carry signals between four types of electronic components: controllers, sensors, switches and actuators.

Controllers will serve as the brains in the vehicle, with each controller managing a subset of vehicle functions, such as the engine, instrumentation, brakes and climate control.

Sensors make up the vehicle's peripheral nervous system, supplying the controllers with real-time performance data, such as throttle position, air-to-fuel ratio, wheel speed and component malfunctions. This data is needed to manage all vehicle subsystems.

Switches are types of sensors that convey signals from the driver and passengers. For example, the steering wheel contains switches that tell the wheels when and how far to turn to negotiate a particular corner.

> The industry is taking a systems engineering approach to vehicular electronics these days.
>
> ▲▲▲

Actuators will handle the "muscular coordination" task in the smart car, relaying data-bus commands and regulating the flow of electricity to the engine and other vehicle systems.

The power bus is the vehicle's bloodstream, supplying a steady flow of electricity to all components. It will run alongside the data bus and link into all the same devices. Power will be delivered to a particular device, such as a headlight or radio, only if that device's actuator has received the appropriate signal from its controlling computer.

Both the data and power buses will interface to vehicle components by means of smart power chips. Smart power chips are intelligent circuit breakers programmed to sense when a short or overload has occurred, close the circuit and periodically test the circuit to determine whether the problem has passed.

Medium

The auto industry has set its long-range sights on fiber optics as the ideal data-bus medium, but it will continue for the foreseeable future to use copper wiring for most implementations. Many passenger cars run low- and medium-speed applications that can be supported adequately with unshielded twisted-pair wiring, says Lee Armstrong, engineering scientist at

(continued on page 40)

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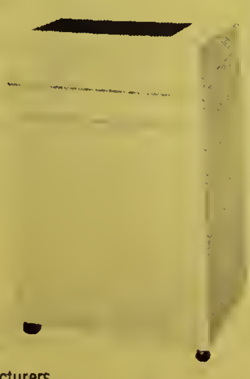

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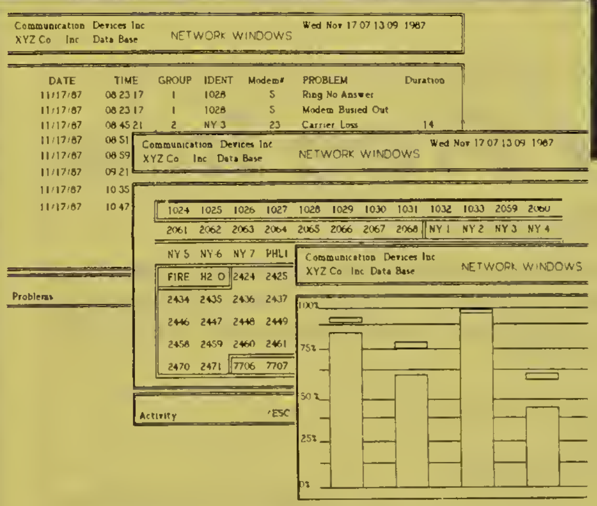

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DATE      TIME      GROUP  IDENT  Modem#  PROBLEM            Duration
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11/17/87  08 23 17  1      1028   S       Modem Busied Out
11/17/87  08 45 21  2      NY 3   23      Carrier Loss       14
11/17/87  08 51
11/17/87  08 59
11/17/87  09 21
11/17/87  10 35
11/17/87  10 47

1024  1025  1026  1027  1028  1029  1030  1031  1032  1033  2059  2060
2061  2062  2063  2064  2065  2066  2067  2068  NY 1  NY 2  NY 3  NY 4
NY 5  NY 6  NY 7  PHL1
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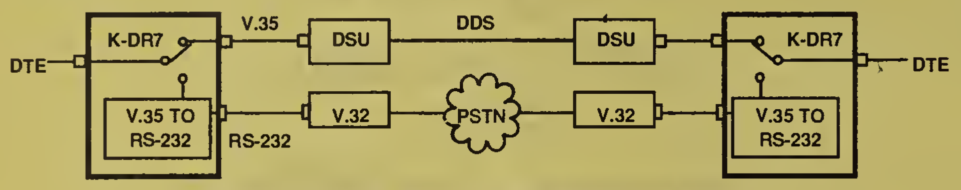

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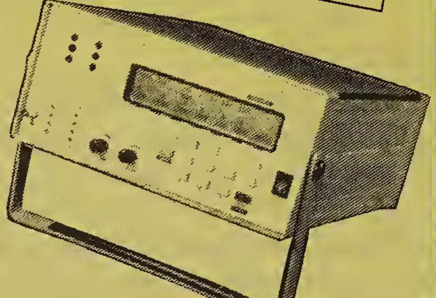

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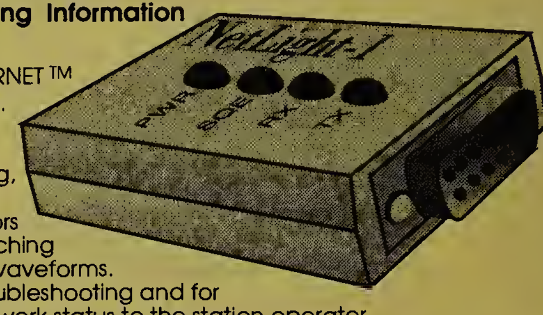

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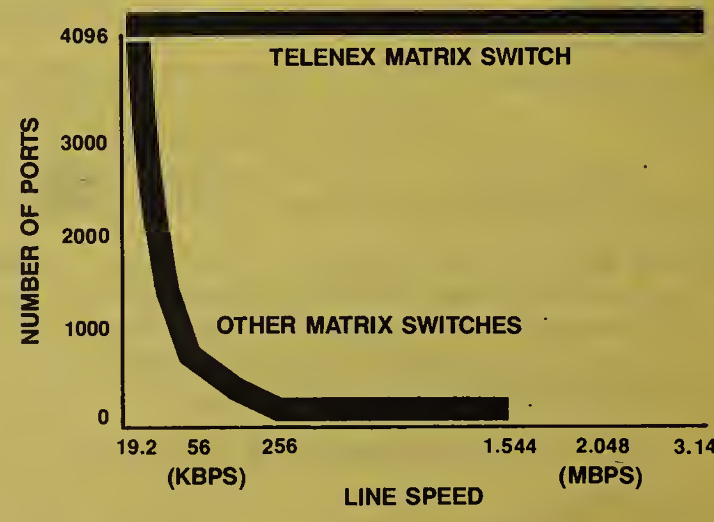

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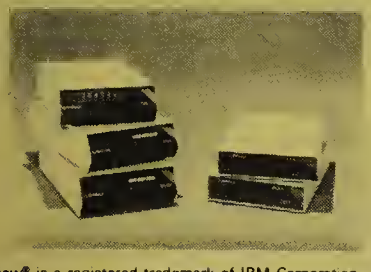

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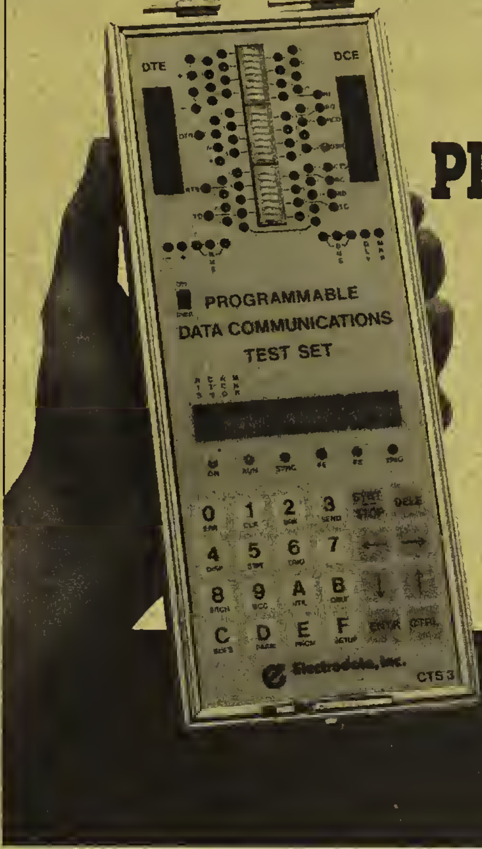

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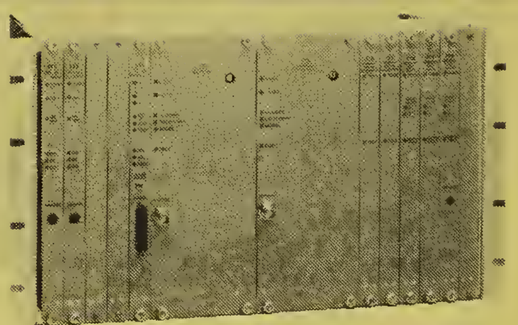

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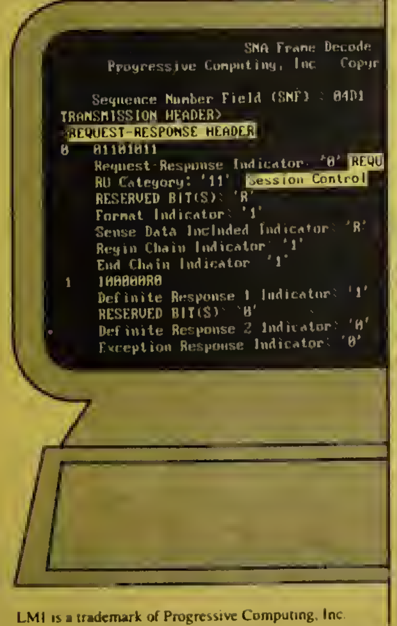

```
                SNA Frame Decode
   Progressive Computing, Inc    Copyr

  Sequence Number Field (SNF) : 04D1
TRANSMISSION HEADER>
REQUEST-RESPONSE HEADER
0   01101011
    Request-Response Indicator: '0' REQU
    RU Category: '11'  Session Control
    RESERVED BIT(S): 'R'
    Format Indicator: '1'
    Sense Data Included Indicator: 'R'
    Begin Chain Indicator: '1'
    End Chain Indicator: '1'
1   10000000
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    RESERVED BIT(S): '0'
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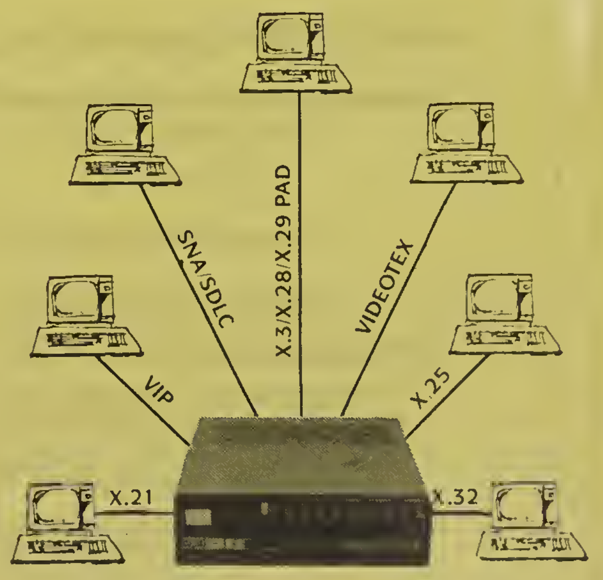

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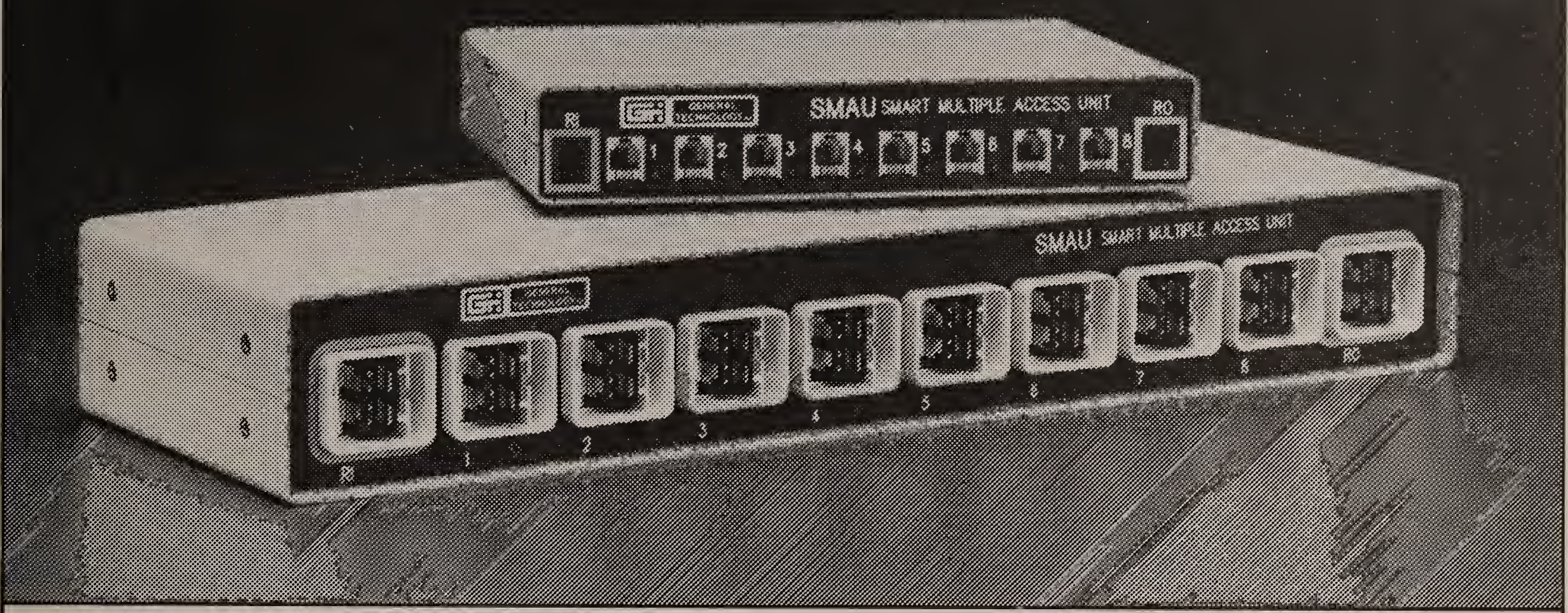

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LED indicators display characteristics of the failure as well as location reporting. (Not just the phantom-voltage-present indication other vendors provide with endless detail.) After the SMAU has reconfigured and restored your token ring network, these indications remain to direct the technician to the exact location of the failure. Once repairs are completed, the SMAU will automatically return the network to its original configuration and indicate normal status.

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Power fail detection insures an orderly shutdown of the affected portion of the network, leaving the configuration intact, as opposed to most other active MAU's. The SMAU with extended range repeaters will disconnect the users on the affected SMAU and automatically bypass to restore the ring. When power is restored, the SMAU will reconfigure and restore the network automatically to its original configuration.

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(continued from page 34)

General Electric Co. in Burlington, Mass.

A significant problem with copper wiring is that it tends to attract stray radio signals, which interfere with in-vehicle data transmissions.

Ultimately, automakers will implement higher quality cabling — shielding twisted-pair, coaxial cable and fiber optics — to support higher data rates and shield against electromagnetically noisy in-vehicle environments, Armstrong says.

Plastic fiber-optic wires may be unsuitable for automotive applications, according to Rivard, because they can melt at the oven-hot temperatures found under the hood of a car. Glass fibers are more heat resistant, he notes, but are also more expensive.

Most auto industry observers regard multiplexing as inevitable.

▲▲▲

Bandwidth

The industry has grouped vehicular multiplexing implementations into three classes — A, B and C — determined principally by their throughput requirements. The J1850 standard will support applications in Classes A and B — those requiring 10K to 125K bit/sec of bandwidth — while CAN will support all three classes, delivering bit rates in excess of 1M bit/sec (see chart, this page).

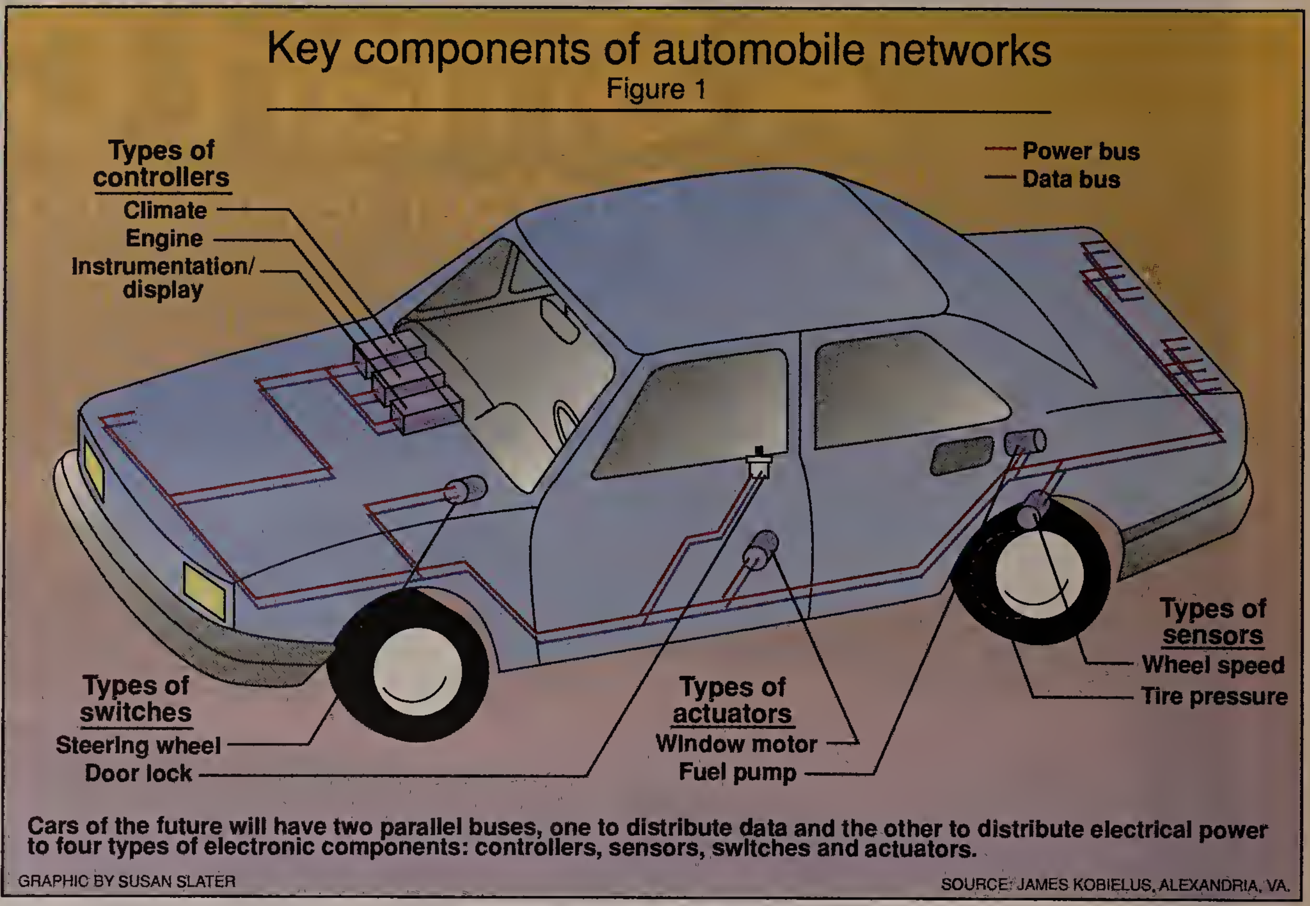
Class A multiplexing systems integrate connections for low-speed applications traditionally served by point-to-point links. Class A's primary purpose is wiring elimination. Most commercial, limited vehicle multiplexing to date falls into this category. The aggregate bit rate for Class A links is about 10K bit/sec. Vehicle functions served by Class A connections consist primarily of instrument panel controls, such as lights, doors, horn and windshield wipers.

Class B multiplexing systems — handling bit rates up to 125K bit/sec — will enable on-board controllers that formerly stood alone to share real-time sensor data. These medium-speed links enable vehicle designers to optimize sensor performance and even reduce the number of on-board sensors through sharing of real-time inputs among controllers. Class B links can also run Class A applications.

Functions that could benefit from real-time sensor sharing over Class B multiplexed links include active suspension and antiskid braking, which currently operate through stand-alone modules at each wheel.

As noted previously, many in the auto industry say they believe Class B links are sufficient for most vehicle multiplexing implementations in the foreseeable future.

Class C multiplexing systems will support high-speed, real-time control functions requiring up to 1M bit/sec of bandwidth, such as torque-demand power train management.



Cars of the future will have two parallel buses, one to distribute data and the other to distribute electrical power to four types of electronic components: controllers, sensors, switches and actuators.

GRAPHIC BY SUSAN SLATER

SOURCE: JAMES KOBIELUS, ALEXANDRIA, VA.

Under this application, vehicles would be able to accelerate and climb steep hills much more smoothly than is currently possible. A central power train controller would gather multiple inputs from engine and transmission sensors while at the same time determining the best way to supply torque to the drive shaft: by increasing engine output, altering the drive ratio or both.

Mary Dolenga, a GM engineer who chairs SAE's Class C Multiplexing Committee, says the industry is still debating whether Class C applications should be integrated with lower speed data or have an internal data subnetwork all to themselves. "Ultimately, the issues of cost and performance will determine the appropriate level of integration," she says.

Protocols

The auto industry appears to be settling on asynchronous data communications protocols for multiplexed applications, as is evidenced by the likely standards, J1850 and CAN. The chips supporting these standards perform all protocol processing necessary to interface functional microprocessors — such as the dashboard display controller — to the data bus.

At the media access control (MAC) level, J1850 uses carrier-sense multiple access with nondestructive arbitration, which, as noted earlier, uses a message prioritization scheme. This prioritization technique is well-suited to an automotive environment, says Chrysler's Miesterfeld, because not all messages and nodes are of equal importance. For example, "step on the brake" will always take precedence over "crank up the stereo" on the bus.

At the session layer, a common requirement of J1850 and other automotive network technologies is the ability to "wake up" most in-vehicle nodes in a single stroke, usually in response to the driver turning the key in the ignition. One way to manage the resulting data surge is by staggering the activation of various components. For example, the engine and other essential systems could be allowed to boot up ahead of the rest.

At the presentation and application layers, SAE is developing diagnostic standards for use by test equipment in monitoring vehicle performance across the multiplexing data link. Standard diagnostic messages will enable technicians to read out vehicle performance data in a consistent format across all makes and models, according to Ron Smisek, a GM engineer who heads the SAE's Vehicle Diagnostics Committee.

Computerized vehicle diagnostics is nothing new. For several years now, the major automakers have been providing dealers with service bay diagnostics capabilities through proprietary protocols and hand-held testers.

The matter is of interest to more than just engineers and grease monkeys, Smisek says. Starting in 1994, a California law will require that all new car models sold in that state incorporate data ports under the dash through which technicians can monitor exhaust pipe emissions. The California statute specifies J1850 as the multiplexing standard for this diagnostics application.

The U.S. Environmental Protection Agency (EPA) is drafting similar regulations on a national scale, according to Bill Clemens, project manager at the EPA's Ann Arbor, Mich., office. If approved, such a rule would relieve mechanics from having to stock different hand-held testers for each vehicle model on which they work, he says.

The right thing to do

The automotive industry has converged around multiplexing as the architecture for vehicle integration, convinced for technical and economic reasons that it's the right approach. Engineers are in the driver's seat on this matter, so to speak, and will continue to refine the technical specifications for linking low-, medium- and high-speed functions across the internal bus.

Most auto industry observers regard multiplexing as inevitable, something that will be as commonplace in cars of the 21st century as the automatic choke is today.

One big question mark in all this is how multiplexing will play — if at all — on Madison Avenue. The marketing folks may have a tough time touting the benefits of vehicle multiplexing. It's just too abstract and intangible for most potential car buyers to understand.

Besides, packets per second just doesn't have the same ring to it as revolutions per minute or miles per gallon.

NETWORK WORLD

Three classes of automotive multiplex nets

Class	Maximum bit rate (bit/sec)	Benefits	Applications	Protocol-supporting applications
Class A	10K	Wiring elimination	Instrument panel controls, vehicle diagnostics	J1850, Controller Area Network
Class B	125K	Sensor-input sharing among existing functional controllers, wiring elimination	Active suspension, anti-skid braking, instrument panel controls, vehicle diagnostics	J1850, Controller Area Network
Class C	1M	Fine-tuned integration among real-time control systems, sensor-input sharing among existing functional controllers, wiring elimination	Torque-demand power train management, active suspension, anti-skid braking, instrument panel controls, vehicle diagnostics	Controller Area Network

SOURCE: JAMES KOBIELUS, ALEXANDRIA, VA.

‘Smart car’ functions

Automotive engineers and designers have identified the following electronic functions for the "smart car" of tomorrow. Vehicle multiplex networks will enable tight integration among these capabilities grouped by functional category:

Instrumentation
- Heads-up display
- Digital dashboard display
- Voice command
- Reprogrammable soft switches

Vehicle controls
- Drive by wire
- Computerized gear shift
- Torque-demand power train control
- Electronic cruise control
- Automatic ride-height control

Safety, convenience and comfort
- Collision avoidance
- Active suspension
- Antiskid braking
- Adaptive external lights
- Power brakes
- "Smart" tires
- Emission control
- Computerized diagnostics
- Theft deterrence
- Rear obstacle detection
- Blind spot warning
- Power seats
- Personalized entry systems
- Keyless ignition

Information, communications and entertainment
- Navigation system
- Cellular telephone
- Radiolocation
- Traffic information

WILL YOUR COMMUNICATION SYSTEM
BE ABLE TO GROW
ALONG WITH YOUR COMPANY?

WILL YOU BE LOCKED OUT OF GLOBAL MARKETS
BECAUSE YOUR NETWORK ISN'T UP TO WORLD STANDARDS?

WILL YOU HAVE ENOUGH POWER TO DELIVER ISDN?

WILL YOU BE READY TO HANDLE VIDEO
WHEN USERS DEMAND IT?

**To know for sure,
you'd need a time machine...**

BellSouth unveils DDOV service

continued from page 5

switch, according to Frank Sui, product manager at INC.

"It appears from the trial results that the [FastConnect] service can significantly reduce network response times at the point of sale," said Steve Lattion, manager of Citgo's credit card operations.

"This would make a big difference to our merchants, who are always looking for ways to reduce the time customers stand in line waiting to pay for merchandise," Lattion said.

Data consolidation

Eventually, the INC central office channel units will be able to consolidate data from up to 20 POS terminals onto a single DS0 B line feeding a packet-switched network. This feature will save money on packet-switching access costs for third-party providers such as J.C. Penney Business Services.

The FastConnect service also eliminates the need for third-party providers to maintain a bank of modems to support incoming dial-up calls from customers.

Instead, calls are communicated directly through multiplexed packet-switching connections.

Eliminating modems also frees up processing power on the computers that would otherwise be needed to set up and terminate dial-up calls, Bender said.

Better service

More importantly, FastConnect will enable third-party processors to provide better service to customers by decreasing the response time for call inquiries.

According to Bender, DDOV provides users with high-speed digital data at prices comparable to analog dial-up connections.

This is because DDOV eliminates the cost of supporting separate lines for voice and data.

BellSouth officials said they will not be able to comment on pricing for the FastConnect service until they finish evaluating the results of the trial.

Token-ring vendor could triumph

continued from page 2

"Madge [Networks] has an excellent chance of invalidating the patent. It's a broad-based data communications scheme that doesn't cover token-ring technology or any of its variants, such as FDDI," said Linda Perry, an independent token-ring designer in Arlington, Mass.

Although no other vendors or industry organization has publicly sided with Madge Networks in its dispute with Soderblom, almost all are privately rooting for the company. "If Madge [Networks] wins, it's a win for all token-ring vendors and users," said L.J. Sevin, an engineer and member of the board of directors for Proteon, Inc., which is among the 50 Soderblom licensees.

Madge Networks' battle with Soderblom has all the appearances of a David vs. Goliath mismatch.

Soderblom ostensibly has the stronger position: Virtually all of the major token-ring vendors license his technology (he reaps an estimated $3 million to $4 million in annual royalties), and three prior lawsuits initiated by Apollo Computer, Inc., Gateway Communications, Inc. and Prime Computer, Inc. were all settled before they got to trial.

IBM, which currently commands 90% of the token-ring market, was the first vendor to license Soderblom's technology in 1980, long before it began shipping its first token-ring product. IBM declined to comment on the ongoing Madge Networks vs. Soderblom litigation last week.

Madge Networks is a privately held company whose annual revenue of $14 million is derived solely from token-ring sales.

Should the federal court side with Soderblom, Madge Networks could wind up paying considerably higher licensing fees than it would have otherwise. Additionally, if the court finds that the infringement was willful, Madge Networks could be enjoined from using the technology.

"We have the option of not licensing Madge [Networks] at all should they lose this case," said George Van de Sande, Soderblom's Washington, D.C.-based attorney. Since all of Madge Networks' business centers around token-ring technology, that could prove disastrous.

"We're on very solid legal ground," Van de Sande said.

Van de Sande noted that the Soderblom patent was challenged before its initial issuance in 1981 and then again when it was reissued by the U.S. Patent Office in 1984. "It was subjected to intense scrutiny by both the patent office and token-ring vendors, which raised every conceivable issue. And every single objection was deemed [to be without merit]," he said.

Ed Murray, Madge Networks' director of North American operations, said his company isn't worried. "We don't feel we're taking a risk because we feel strongly that Soderblom's patent is not applicable to token-ring technology. The chances of Soderblom putting us out of business are nil," Murray said.

Madge Networks President Robert Madge is adamant that his company won't opt for a settlement. Both sides are in discovery, and it will be at least a year before the case comes to trial.

Roger Borovoy, a patent attorney with Brown & Bain Co. in Palo Alto, Calif., said he thinks Madge Networks could win the lawsuit. Borovoy, a former chief executive officer at Proteon, helped negotiate that company's settlement with Soderblom.

"Soderblom's patent is a very skimpy disclosure. It doesn't specify token-ring, FDDI or even a peer-to-peer transmission scheme," he said. "Soderblom did a very clever job of not asking vendors for large royalty payments. He asked just enough so that it wasn't worth it to the vendor to litigate. If Soderblom had asked more from Proteon, we would have litigated."

Banks back consolidation

continued from page 5

network that is owned by 720 New England banks and has 3,600 ATMs.

Bank mergers "might be one of the most important factors in consolidating ATM networks," Yanak said.

As states continue to lift interstate banking restrictions, it is likely smaller banks will be swallowed up by larger ones moving into new regions, Yanak said.

After the acquisition, these larger banks will often find themselves part owners of two or more regional networks. In order to reduce operating expenses, the larger banks will probably try to gain consent from other part owners to merge the regional networks, he said.

Yanak said that the Plus and Cirrus networks should be merged into Visa's and MasterCard's credit card authorization networks once regional networks have been consolidated. This will obviate the need for networks to route ATM traffic nationally.

Although both Tonguette and Yanak feel regional networks will continue to play a role in overall ATM networks, some banks disagree.

For instance, Banc One Corp. of Ohio and BankAmerica Corp. of San Francisco would rather use Plus or Cirrus to supplement the number of ATMs in their proprietary ATM networks.

"Our stance is not to be in a regional network," said Bruce Luecke, vice-president of product development for Banc One. Banc One operates its own ATM network, called Jubilee, and is linked to Plus.

> Bank mergers "might be one of the most important factors in consolidating ATMs."
>
> ▲▲▲

This enables Banc One to keep the number of logos displayed on its ATM to two, its own and Plus,' he said. It also saves Banc One from shelling out membership and ownership fees for various regional networks.

LAN lets voice, data share cable

continued from page 19

LAN services, its PC/Telephone Application Node token-ring adapters will initially ship with drivers for Novell, Inc.'s NetWare network operating system, enabling users to run the software and provide file, print, messaging and data base services for end users.

Another critical component of TriLAN is the PBX/CO Gateway, a stand-alone interface between the token ring and a PBX or central office switch that will also support access to Integrated Services Digital Network Basic Rate Interface offerings. The company is also developing support for the Primary Rate Interface.

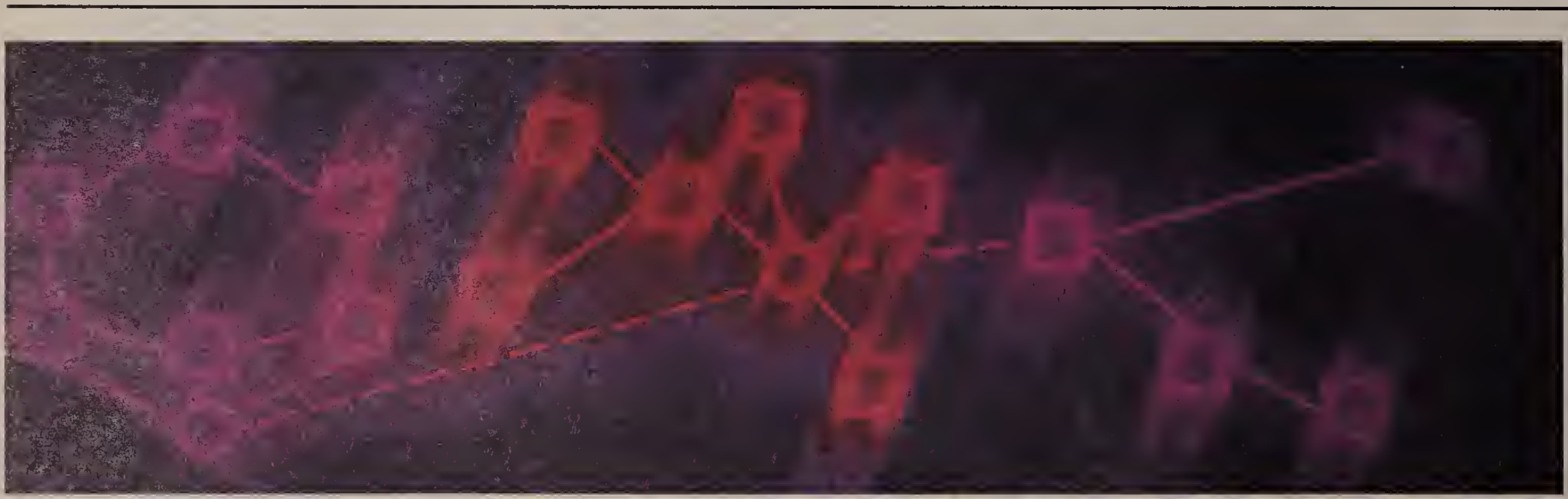
The PBX/CO Gateway provides a circuit-switched interface to an on-premises PBX or a central office-based switch. It is a modular unit that houses up to six PBX/CO line cards, each of which supports eight incoming trunks or PBX lines. The gateway provides a single link to the token-ring net.

The company will eventually support video traffic through either hardware or software on the personal computer, though details have not been finalized, said Victor Nowakowski, engineering manager at Dukane's Network Integration Division.

A TriLAN network supporting eight to 12 users costs $15,000 to $20,000, including NCUs, system software, personal computer interface boards, telephones and the PBX/CO gateway.

TriLAN will be available in the fourth quarter of 1990.

Dukane Network Integration can be reached in writing at 2900 Dukane Drive, Saint Charles, Ill. 60174, or by calling (708) 584-2300.



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Retailers mull shared network

continued from page 2

Chay, NRMA's vice-president of MIS, to look at sharing network services.

B. Dalton Booksellers, a $200 million book chain, has already commissioned a study, which began this month, to determine what types of retailers would be interested in sharing a network and what services they would agree to share.

Trader Joe's Morsheimer said he became interested in building a shared network because "satellite vendors kept coming up to me, trying to sell $650,000 systems for which I would be paying 100% of the cost and using only 10% of the capacity. I knew I wasn't alone."

Positive side of frustration

Mark Lilien, vice-president of systems and distribution at B. Dalton in New York, said, "We have a lot of locations, but we still don't have enough transactions to make running our own network cost-effective." B. Dalton has more than 1,000 stores, compared to Trader Joe's 31.

Lilien said his company commissioned the Kurt Salmon Associates study largely out of frustration with the level of customer service that B. Dalton could provide using its existing dial-up facilities. Using dial-up lines for credit checks during the Christmas rush creates noticeable delays, he said.

Lilien said he figured that since B. Dalton is situated in the same malls as many other retail chains, there is plenty of potential for consolidated network efforts.

Dave Denny, a principal at Kurt Salmon Associates in Atlanta, said he hopes to round up a group of specialty retailers within the next two months to discuss putting a pilot program in place. The primary shared network application being studied is credit authorization, with point-of-sale terminal polling also on the agenda, he said.

At this point, it is not clear what type of network will be built if the specialty chains decide to build one at all, Denny said.

"We're not only looking at private networks, but also value-added networks," he said. "Many retailers assume a satellite network is the way to go, but we'll look seriously at radio and terrestrial services also."

Vendor participation

Morsheimer is optimistic that some sort of shared network will be in place by next year. He has been actively soliciting potential offerings from network and equipment service vendors.

For example, providing services geared toward specialty chains appeals to US West Communications, the telephone operating business of US West, Inc., according to Bill Vance, market manager of Large Business Services there.

"The specialty store market looks like a real growth opportunity that someone else is going to take if we don't," Vance said.

IBM adds potent PS/2 servers

continued from page 1

perts expressed disappointment that IBM did not introduce a server based on the 80486. "Why they didn't come out with a 486 system is unfathomable," said John Murphy, a senior consultant with Amy Wohl & Associates, Inc., an office automation consultancy in Bala-Cynwyd, Pa.

Frank Dzubeck, president of Communications Network Architects, Inc. in Washington, D.C., said the choice to base the Model 80s on single 25-MHz 80386 processors means they "won't compete on a one-to-one basis" with superservers recently introduced by Compaq Computer Corp., Hewlett-Packard Co. and NetFRAME Systems, Inc.

Those companies' products can incorporate multiple 80486 processors and have special mainframe- or minicomputer-like disk and I/O subsystems.

The new Model 80s "compete in a marketplace that is below these superservers," Dzubeck said. "The Model 80 has been around for three years, and a lot of clone manufacturers came up with faster towers in the interim. IBM now has a faster tower that competes with those clones."

There is some sentiment that IBM is holding back on releasing a true superserver because it would compete with larger IBM hosts. "They are concerned about taking away sales from their other systems, like the new RISC machines and, especially, the AS/400 line," said David Passmore, a partner at Network Strategies, an Ernst & Young network consulting practice.

However, Dzubeck maintains that the new Model 80s are at least on par with Compaq's SystemPro superserver at everything but the processor level. Multiple SCSI bus master controllers doing overlapped I/O at the Micro Channel bus's 40M byte/sec burst-mode speed can provide a disk subsystem at least equal to the specialized disk arrays in the SystemPro, he said.

According to Dzubeck, IBM is holding back on releasing a true superserver with multiple 80486 processors until OS/2 2.0 and its LAN Server network operating system derivative of LAN Manager 2.0 are finished. IBM's LAN Server is a version of Microsoft Corp.'s LAN Manager.

"It's an issue of timing," Dzubeck said. "If IBM released a 486 server now, only Novell's NetWare 386 [network operating system] could take advantage of it. IBM would be linking its superserver to the wrong network operating system."

Meanwhile, Novell and IBM have developed NetWare drivers for IBM's new SCSI bus master controllers, so NetWare 386 and NetWare 2.1X will run on the new Model 80s. The drivers will be included as part of NetWare 386 and NetWare 2.1X at no additional charge, Novell said.

"Novell's [NetWare is] currently being used by many of our PS/2 customers," said Jim Cannavino, vice-president and general manager of IBM's Personal Computer Division. "Novell's support helps assure popular acceptance of our new high-performance PS/2s."

The Model 80 386 A31 and the Model 80 386 A21 have an integrated SCSI interface that supports a 32-bit SCSI controller with 512K bytes of disk cache memory. The controller drives a new 320M-byte, 3.5-in. SCSI hard disk that boasts an access time of 12.5 msec. Four of the drives can be installed in a single system, providing more than 1.2G bytes of internal storage.

The base systems come with 4M bytes of random-access memory that is speeded up by a 64K-byte memory cache. Equipped with a single 320M-byte hard drive, the A31 costs $13,195 and the A21 is priced at $10,695.

IBM also announced the availability of the previously introduced 1.2 versions of OS/2 Extended Edition and OS/2 LAN Server.

Among other enhancements, the new OS/2 Extended Edition and LAN Server versions include OS/2's High Performance File System, which is much faster than the DOS file system of earlier versions. Also, the previously stand-alone Data Manager in OS/2 Extended Edition now has a Remote Data Services feature that enables it to operate as a shared data base server across a LAN.

OS/2 Extended Edition 1.2 is priced at $830 per workstation, and users of OS/2 Extended Edition 1.1 are eligible for a free upgrade. LAN Server 1.2 costs $1,040 per server.

Vendor/user teams fill gaps

continued from page 1

IBM also partnered with McKesson Corp. on an automated help desk problem management system and was the ultimate beneficiary of a partnership between Union Pacific Railroad and US West Network Systems, Inc. (NSI). Those firms developed the NetCenter Service Point Interface, a link to non-IBM devices for the NetView graphic interface that IBM acquired from NSI.

For some users, working with vendors is simply part of their business strategy.

"We've worked to establish partnerships with our key vendors," said Bud Turner, director of data center services for San Francisco-based McKesson, a $7 billion distributor of drug and health care products. "We bring them into the organization, they attend our planning meetings, work with our processes, and understand our organization and where it's going."

The strategy has paid off on numerous occasions, including a project in which IBM helped McKesson develop software that lets help desk personnel automate routine tasks.

McKesson originally hired a programmer to develop DOS-based prototype software, then IBM stepped in and worked with McKesson to evolve the product into what is now IBM's OS/2-based Problem Management Productivity Services, which IBM announced last year.

McKesson also worked with Pacific Bell to design a service-level management system that lets McKesson track busy signals and determine the number of phone lines it needs, as well as identify peak calling periods.

"A couple of years ago, the telephone company wouldn't even tell you where your circuit rode, let alone have an engineer come out there and help you design a service like that," Turner said. "The corporate giants used to have the feeling that whatever they brought out was what the customer would buy."

IBM acknowledges that it is putting more emphasis today on identifying customer needs before it develops a product, even to the point of involving users in the development process.

IBM's ImagePlus product is a prime example. The first two versions, one for MVS/ESA and the other for the Application System/400 minicomputer, were jointly developed with United Services Automobile Association and Citibank, respectively.

In addition, an ImagePlus application IBM announced two weeks ago for processing checks was developed with the help of six banks, said David Liddell, manager of marketing plans for image application systems at IBM ("IBM unveils net tools for financial sector," *NW,* March 19).

By developing its products with the help of those most likely to use them, IBM can accommodate user needs up front, rather than trying to change the product later, Liddell said.

There is no specific profile for the type of user IBM will work with, he said, and it isn't necessary to be a major customer, although IBM partners do tend to be leading-edge users.

Users echoed Liddell's comments.

"You have to be able to bring something to the table," said Sam Coffee, manager of telecommunications systems for Union Pacific. Union Pacific was twice able to do so, and has advanced network management tools to show for its efforts.

Besides the NetCenter Service Point Option it helped develop with the now-defunct NSI, Union Pacific also worked with Diederich & Associates of South Pasadena, Calif., to develop software that simplifies the task of developing NetView/PC applications, including those that work with NetCenter.

Coffee said NSI chose to work with Union Pacific not because it has the biggest network, but because its net is representative of other large networks. The net includes a broad range of devices and technologies, including fiber optics, microwave and various modems and multiplexers.

The same was true for Diederich & Associates.

"We knew NetCenter and Diederich knew NetView/PC. And out of that came a product that Diederich's marketing [department] called NetScript application generator," Coffee said.

But such financial deals are clearly not the main impetus behind user/vendor development efforts. Rather, it is to solve a pressing need.

"As a rule, [vendors] tend to tell you what their solution is and try to convince you to change the way you do things to match their solution," Coffee said. "It's nice to find a company that's willing to work with you to examine your problem and to jointly try to come up with a better solution."

Telecommuting may help firms

continued from page 4

compared with employees working in the office.

J.C. Penney Co., Inc. currently has more than 250 flexible-time customer service representatives working at home. These telecommuters have a home setup similar to that of the Travelers employees. Calls are routed to individual homes via an ACD at a local call distribution center, and home terminals are linked to company mainframes via a separate dial-up phone line.

A major advantage of having customer service representatives work from home is that managers can assign hours on an as-needed basis, satisfying both employee and company needs.

For example, J.C. Penney boosts most of its part-time telecommuting employees up to full-time during peak traffic periods simply by routing calls to them during more hours of the day. Also, telecommuters provide an instant source of emergency replacement help, covering for employees who cannot get into the office due to inclement weather or personal emergencies.

Different flavors of ISDN hamper users

continued from page 1

the two standards groups.

"ISDN is being rolled out according to different standards around the world, which will make it more difficult to use on a global basis," he said.

The ISDN incompatibilities fall into two camps. The first is that carriers and central office switch makers in different countries are working with various standards for connecting customer premises equipment to the public network. These differences have arisen because of the range of options in CCITT ISDN standards (see graphic, page 1).

Many carriers were eager to get into ISDN early and deployed proprietary ISDN services roughly based on the 1984 Consultative Committee on International Telephony and Telegraphy Red Book recommendations. Other carriers are deploying ISDN services based on the 1988 Blue Book recommendations. These newer services typically cannot accommodate terminal equipment built to support the older services. In other instances, carriers are adopting incompatible versions of the 1988 Blue Book standards.

These incompatibilities apply to both Basic Rate Interface (BRI) and Primary Rate Interface (PRI) services, and reflect, among other things, different implementations of signaling systems and differences in underlying public network technologies.

For example, European carriers base their PRI service on a 2.048M bit/sec E-1 standard, while North American carriers use the 1.544M bit/sec T-1 standard.

The upshot is that users implementing ISDN in several countries probably won't be able to standardize on a single vendor's terminal equipment. That means users will find it difficult to leverage volume discounts on international equipment purchases and will have to train employees to use multiple systems.

No D channel capability

The other major compatibility problem is that carriers aren't yet equipped to handle international ISDN D channel transmissions. As a result, AT&T's so-called international ISDN service is actually only an international switched 56K or 64K bit/sec service accessed at either end by ISDN links.

Specifically, AT&T, the only U.S. carrier offering "international ISDN," really only gives PRI subscribers access to switched 56K or 64K bit/sec links to France, Japan or the U.K. Other countries will be added during the course of the year, according to to Drew McCahill, international ISDN product manager at the carrier. AT&T also supports BRI access to these international switched 56K or 64K bit/sec services.

But without D channel connections to ISDN services in other countries, several advanced ISDN applications, such as the ability to dynamically reallocate bandwidth and support ANI, cannot be provided over international links.

Working together

Carriers are working hard to sort out the incompatibilities, which may make ISDN more attractive to international users in the future.

For example, 24 European carriers are working to support common ISDN standards and full ISDN terminal equipment portability between nations by the end of 1993 (see "Europe strives for common ISDN by '93," page 17). And according to McCahill, by year end, the world's major carriers will begin deploying a portion of the CCITT-defined Signaling System 7, called ISDN User Part, that will enable them to support international D channel transmissions and ANI.

He added, however, that just because carriers will be able to support international D channel transmissions, it doesn't necessarily mean they will deploy advanced applications. Tariffing restrictions, marketing concerns and regulatory problems may delay commercial offerings.

Meanwhile, users and carriers are ramping up their international ISDN plans. Terry Kero, director of information and communications systems support at US Sprint Communications Co., said the carrier may make an international ISDN announcement "in the May time frame." Both MCI Communications Corp. and US Sprint are planning to deploy their first domestic ISDN offerings this quarter.

McCahill added that demand for AT&T's international ISDN service is growing and that approximately 12 customers subscribe to it already.

Among users, a spokesman for New York-based American Express Travel Related Services Co., one of AT&T's biggest domestic ISDN customers, said the company is likely to begin using ISDN internationally by year end. ◻

Users implementing ISDN in several countries probably won't be able to standardize on a single vendor's terminal equipment.

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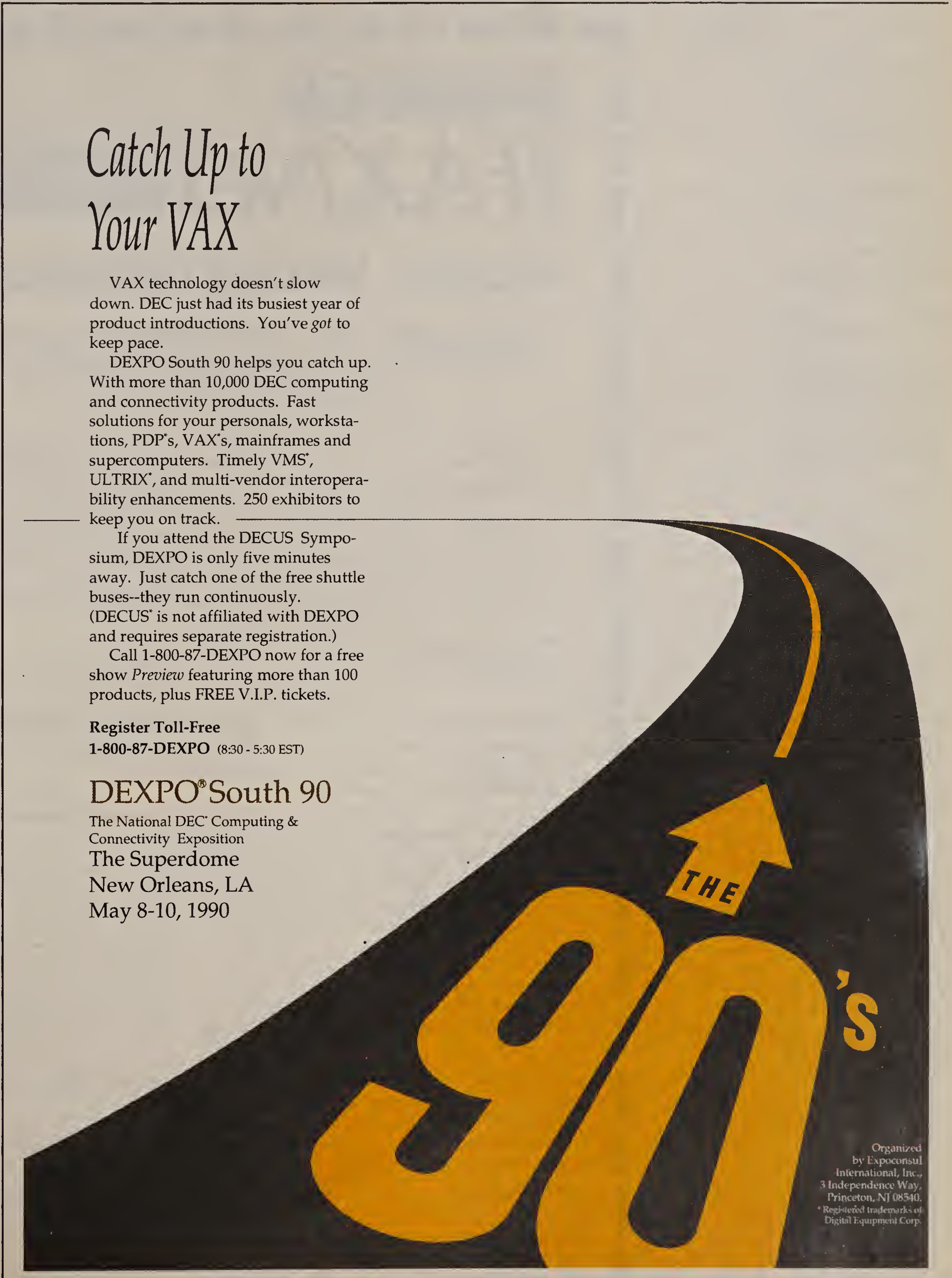

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Internet hacker frustrates users

continued from page 4

identifying himself as the hacker said a primary target of the network attack was Clifford Stoll, a computer system manager at the Harvard-Smithsonian Astronomical Observatory. Stoll was sent a message by the hacker in reaction to his portrayal of hackers in a recent book.

The hacker is said to have accessed the various systems by trying common passwords, or "rattling doorknobs until he found ones that opened," as one user put it. The hacker is not believed to have used a rogue program, such as a virus or the worm used by Morris when he created chaos on the Internet in November 1988. Morris is to be sentenced in May for his illegal actions.

Investigators are expected to have difficulty apprehending the culprit since the hacker is believed to have erased his tracks as he moved from one computer network to another, a CERT spokesman said.

Even though the hacker attempted to cover his tracks, users could see their systems had been tampered with. Telltale signs included notification of the last time someone had logged into an account, users said.

Some victims of the network intrusion, including the Harvard-Smithsonian Astronomical Observatory, went so far as to disconnect their networks from Internet. Mostly, though, the break-ins caused frustration.

"Although there was no damage and this doesn't come close to the [Morris incident], I'm upset," said Kent England, director of networks at the Information Technology group at Boston University, a hacker victim. England was angered that the hacker was able to break into Harvard's computers through a Boston University computer, he said.

"This incident points out that Internet still is and always will be susceptible to individual attacks," England said. "We've got to do a better job of security management and make sure passwords cannot be easily guessed."

The attacks are further proof that computer networks are sitting ducks, according to Peter Tippett, president of Foundation Ware, a Cleveland-based software publisher.

"Networks, which have processors distributed everywhere, are extremely vulnerable to attacks," Tippett said. Last week, Tippett released a paper titled "Kinetics of Computer Virus Replications," in which he warns that computer viruses are multiplying in "epidemic proportions," thanks in large part to the proliferation of networks.

CeBIT '90 showcases OSI's power

continued from page 1

start," he said.

The larger of the two OSI demonstrations was staged by EurOSInet, a nonprofit association of 50 European hardware and software vendors. All together, 29 vendors and nine user companies took part in the demonstrations.

EurOSInet's demonstration was based on mock business scenarios in which users were exchanging data with customers, banks and suppliers using OSI protocols such as File Transfer, Access and Management (FTAM) and X.400.

The scenarios, each of which used a different mix of vendors' equipment, included applications in banking, manufacturing and office productivity, as well as a fourth application in which several chemical companies exchanged project data with a client over an OSI network.

Although the demonstration was staged for the CeBIT show and did not include actual production systems, it did show products from 29 different vendors working together across a common X.25 backbone.

The OSI demonstration was EurOSInet's second at CeBIT, although this year's demo included participation from seven more users and added two new applications: X.500 directory services and Office Document Architecture (ODA). ODA is an OSI standard for a document format that can include text images and graphics.

In the chemical company scenario, ODA was used by four chemical companies — including Exxon Chemical International, Inc. and Hoechst AG — to communicate with Iberduero, a Spanish power company. ODA documents from each supplier were shipped via X.400 to a Digital Equipment Corp. MicroVAX. Using DEC's Compound Document Architecture, the MicroVAX consolidated the documents into a single file.

FTAM was used to transfer price lists, and bills were paid in conjunction with a French and a German bank using electronic data interchange via X.400.

X.500 makes debut

The EurOSInet exhibit also featured the first showing of multivendor interoperability based on X.500 directory services.

Retix, a Santa Monica, Calif., OSI software company, demonstrated a prototype of an X.500 product running under Unix that it expects to announce later this year. The product was working in tandem with X.500 products from six other vendors, including IBM. IBM demonstrated the subset of X.500, which is included in its OSI/Communications Subsystem mainframe software due out this month.

> This year's MultiNET demo at CeBIT focused on integration of TCP/IP and OSI protocol.
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In the exhibit, IBM could find the location of applications located on any other vendor's equipment using only the application name, rather than its address.

Retix's product takes that function a step further and includes the ability to find an individual user's X.400 mail address using only the user's name and any other pertinent information the requestor may know.

This year's MultiNET demonstration at CeBIT focused on integration of TCP/IP and OSI protocol and how to migrate from TCP/IP to OSI.

Toward that end, 21 vendors set up a network in which each was able to communicate with the others using a mix of TCP/IP and OSI application-layer protocols over OSI local- and wide-area networks, including Ethernets, token rings, Fiber Distributed Data Interface (FDDI) backbones and X.25 nets.

The vendor booths, which filled the small CeBIT exhibit hall, were attached to one of two IEEE 802.3 Ethernets or an IEEE 802.5 token-ring network. Those three nets in turn were linked to an FDDI backbone using equipment that included FDDI routers from Fibronics GmbH, an affiliate of the U.S.-based Fibronics International, Inc. Various vendors also implemented X.25 links to the fiber backbone, LANs and X.25 net.

XGMON plays role

IBM managed an array of equipment in the demonstration using XGMON, its prototype TCP/IP net management system that is the basis for AIX Network Management/6000, a recently announced product running on IBM's new RISC System/6000 AIX machines.

For the MultiNET demonstration, IBM also showed software that links XGMON to NetView. In the demo, NetView was shown monitoring an AIX-based RT system on an Ethernet, a 9370 host on which NetView was running and an OS/2-based personal computer attached to a token-ring net.

From the same console — an RT-attached workstation emulating a 3270 terminal — a NetView operator could monitor all those devices and request data such as performance statistics from any of them.

AT&T to sell Audix voice mail as stand-alone unit

By Bob Wallace
Senior Editor

ANAHEIM, Calif. — AT&T is expected to announce this week a plan to sell its Audix voice mail system as a stand-alone unit that can be interfaced with private branch exchanges from NEC America, Inc. and Rolm, an IBM and Siemens AG company.

AT&T will announce the change, which represents a major departure from its four-year strategy of selling Audix as an integrated system with its own switches, at the Voice '90 conference here this week.

Audix will work with the IBM 9751, Rolm CBX 8000 and 9000, and the NEAX 2400, in addition to AT&T's Dimension, System 75, System 85 and Definity Generic 1 and 2 PBXs.

Users "with a multivendor PBX network in place or who have another vendor's telephone system can now use Audix as a stand-alone system," said Carolyn Ring, voice-messaging product manager for AT&T's Business Communications Systems group.

Audix systems interfaced to non-AT&T PBXs will support standard Audix features, including the ability to create, send, receive, store and broadcast messages, but not other functions provided when the system is integrated with an AT&T switch.

With interfaced systems, a caller who receives a busy signal must reenter the extension number to reach the voice mail system. With integrated systems, the PBX automatically forwards the call to voice mail.

Furthermore, integrated systems can instruct the PBX to light a message-waiting indicator on the user's telephone set, whereas interfaced systems, at best, can alert users of waiting messages by providing broken dial tone.

Early on, PBX vendors refused to interface their voice mail systems to their rivals' switches.

"AT&T and other PBX vendors initially viewed voice mail as a way to sell switches," said Lisa French, a senior associate at Vanguard Communications Corp., a Santa Clara, Calif., consultancy specializing in voice processing technologies. "They integrated their PBXs and voice mail systems to lock in customers."

Customer demand for voice mail systems that work with a variety of vendors' switches accelerated the emergence of firms such as Centigram Corp., Octel Communications Corp. and VMX, Inc., and it forced the PBX vendors to alter their strategy, according to French.

"The PBX vendors realized that they had to open their interfaces to compete with the independent voice mail vendors," French explained.

Vanguard's latest voice mail research shows that only one of the top three PBX vendors — AT&T — was among the top three voice mail vendors in 1989 revenues. Octel finished first with $131.27 million, AT&T placed second with $87.25 million and VMX took third with $65.81 million. French said the bulk of AT&T's voice mail revenues were generated by sales of its very low-end Audix VoicePower line.

Pricing for a stand-alone Audix system starts at about $45,000 for a four-port system with 14 hours of storage. The largest Audix system, a 256-port system with 104 hours of storage, costs roughly $229,000.

AT&T moves to revamp rates

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$100 for T-1, and from $300 to $450 for T-3.

The proposal calls for dropping the monthly function connection fee but retaining the charge as an installation fee. Under the proposal, the charges for central office functions are: $20 per channel for ASDS, $50 per channel for 56K bit/sec Dataphone Digital Service, $100 for T-1 circuits and $450 for T-3 lines.

Kornet claimed that, all told, the majority of customers will end up paying less for central office connections if the changes are approved by the FCC.

Encouraging upgrades

In an effort to make it easier for users to upgrade to higher capacity access services, AT&T is proposing to cut the cost for users that want to install AT&T's M-24 service, which enables users to channelize 24 wide-area voice-grade lines into a T-1 access circuit.

Under the existing tariff, customers that connect a T-1 line to an M-24 multiplexer must pay installation charges for the T-1 central office connection, the multiplexer and each derived channel.

AT&T is proposing retaining the current T-1 central office installation charge at $310, eliminating the $196 installation charge for each channel, and raising the multiplexer installation charge from $500 to $1,000. This would cut overall installation costs by roughly 75%, from $5,514 to $1,310.

A third proposal filed by AT&T last week would raise by $3 the monthly charge for customers using analog access services on multipoint voice-grade private-line and ASDS multipoint circuits.

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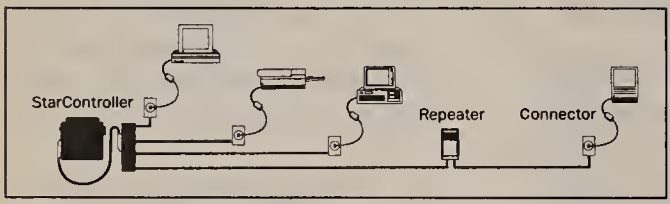

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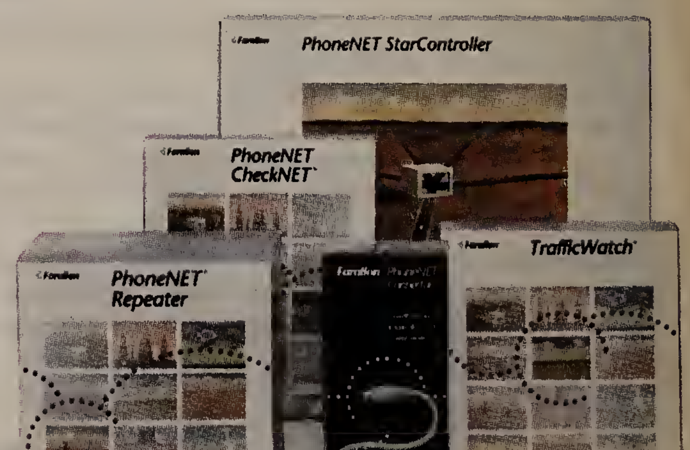

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